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BRUCE'S SCHOOL SHOP ANNUAL

The content of this, the twelfth edition of *Bruce's School Shop Annual* has been chosen so that it possesses much of present as well as future value to all interested in industrial arts and vocational education.

Of special interest is the group of articles on "School-Shop Budgeting." These were all contributed by men of experience. Those written by Earl L. Bedell, Roy R. Van Duzee, and H. M. Jellison bear the viewpoint of the supervisor and administrator, while those contributed by Harold H. Kirk, H. D. Campbell, and E. W. Jones were written from the angle of the man who is actively engaged in teaching a specific subject.

The section on "School Shops" contains splendid articles on the industrial-arts laboratory in the large school system, and on shop programs and layouts for vocational high schools, cosmopolitan high schools, junior high schools, and teacher-training institutions.

Among the "Shop Courses" will be found two for rural schools, one for the auto shop, and another for the printers. There is also an excellent course outline for related science and one for welding.

"Shop Safety," too, is represented by notable contributions, one of which has been specially written for this issue by W. H. Cameron, managing editor for the National Safety Council.

Another outstanding article is the one in which Superintendent of Schools, William H. Johnson, describes the home-mechanics offerings now presented in the public schools of Chicago.

Besides the foregoing, there are a number of other articles which will be found helpful not only for the present, but also for the years to come.

Articles Indexed — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."
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The Magazine is on sale at Brentano's, New York; Wanamaker's, Philadelphia; Brentano's, Chicago; Phillippine Education Co., Manila, P. I.

J-45 SPINDLE SANDER

Ever since its introduction, the J-45 Oscillating Spindle Sander has been accepted with confidence and favor by school shop men. Now that it has been redesigned and improved, we predict even greater popularity for this splendid machine.

It is ruggedly built for continuous service. The base is a heavy one-piece casting which not only provides a strong foundation, but serves to enclose the drive motor and the entire oscillating mechanism. The only moving part exposed is the sanding roll itself.

The table is cast iron with a ground finished top surface. It may be tilted 45° to the left and 15° to the right, and may be adjusted vertically to allow full utilization of the entire abrasive roll without blocking up the stock.

On almost every type of project, you and your students will find many uses for this sander. In cabinet work and pattern making it saves hours of tedious hand labor on internal and irregular surfaces. Besides, it is the very same machine that is being used widely in furniture factories and pattern shops the country over. Its value and its usefulness have been proven.

You will like the way the ball-bearing motor is coupled directly to the main spindle to provide a very positive and efficient drive. Both motor and spindle oscillate together, being controlled by a hand lever on the outside of the base. The motor and the oscillation mechanism are enclosed in a dustproof compartment which excludes harmful dirt yet provides adequate ventilation. The spindle runs in large ball-bearings equipped with dust seals. We will be glad to send you more information. Write today!

YATES-AMERICAN MACHINE COMPANY • BELOIT, WISCONSIN

This is the fifth of a series of brief articles dealing with various woods, their properties and uses. It is our hope that they might make interesting and helpful classroom material. We will welcome your suggestions as to the species of wood you would like featured in this series.

YATES-AMERICAN

SHORT TALKS ON WOOD

SWEET GUM (*Liquidambar styraciflua*)

Among hardwoods, sweet gum is exceeded in commercial importance only by the oaks. It is heavy, moderately hard, has an even texture and is comparatively easy to work. The heartwood is reddish-brown in color and noted for its attractive grain. Sapwood is almost white.

Sweet gum is marketed under two names—lumber which contains sufficient heartwood is known as red gum, the balance as sap gum. Red gum is used for furniture, interior finish, veneer and cabinet work for its own qualities and in imitation of mahogany and Circassian walnut. Sap gum is used for factory lumber, cooperage, boxes, railway ties and soda pulp.

Sweet gum grows naturally from Connecticut to Florida and westward to Kansas. The commercial range is confined to the moist lands of the lower Ohio and Mississippi River basins and the lowlands of the southeastern coast.

A handsome and symmetrical tree. Grows rapidly, and in favorable locations reaches heights up to 120 feet and diameters up to 4 feet. Its ornamental value is being recognized.

On older trees the bark is grayish-brown, scaly and deeply furrowed. On younger trees it is smoother and dark gray. The leaves are simple, alternate, 3 to 5 inches long, broader than long, star-shaped, five-pointed. Aromatic when crushed. The fruit is a long-stalked, round head made up of many capsules, each containing small seeds.

School-Shop Budgeting

Budgeting School-Shop Departments

Earl L. Bedell

Director of Vocational Education, Detroit, Michigan

Factors that must be considered if school-shop budgeting is to be done properly.

Each school system has developed its own particular pattern of financing its educational programs. Whatever may be the variations certain basic procedures will be found common among all of them: (1) a budget or estimate must be prepared showing the requirements for the ensuing year, and presented to the appropriating body; (2) the taxes must be levied, collected, and turned over to the school authorities; and (3) the school authorities must spend the money to operate the schools. Preparing a budget that is acceptable to the appropriating body, and then spending the money satisfactorily after it is collected, are administrative functions which challenge the abilities of school executives.

Financing the building program, providing for the payroll of the teachers, and supervising the operation and maintenance of the school plant is handled under the direction of the superintendent. In contrast to the personal attention the superintendent will give to some of these problems when they concern general education, is his readiness to delegate many of the responsibilities to a staff assistant when the problems affect a practical-arts department. Few superintendents are willing to give personal supervision to the school shop, the drafting room, or the home-economics laboratory unless a plan, in considerable detail, has been prepared for them. In the larger school systems there is a supervisor or other staff officer to whom the superintendent can delegate the jobs of equipping, maintaining, and operating the practical-arts programs, but in smaller systems these duties will devolve upon the teacher.

This whole discussion will revolve about the responsibility that rests upon the shop teacher or supervisor in equipping and maintaining the practical-arts programs. The superintendent is the one held officially responsible by the community; the public-school program stands as the objective evidence of the superintendent's efficiency. Therefore, the teacher or supervisor must valuate every expenditure, and every proposed activity in terms of its relationship to the entire educational program in the community. This implies also that the teacher or supervisor must have the ability to co-operate with all other divisions and departments within the school system. Although the job may be specific, the fact that it is a part of a larger program should be kept continually in mind.

Standard Equipment and Supply Lists

The introduction of the practical arts into the scheme of public education has been closely associated with the use of machines, tools, and materials. Practical-arts education has always emphasized the manual or manipulative skills. The development of skills in the use of tools in shaping materials has always occupied a prominent place in the thinking of both the teachers of industrial arts and the teachers of industrial trades. In fact, shops, the tools, the machines, and the materials required for our school programs have become too often synonymous with our educational objectives.

Scientific course construction in shop courses requires a careful analysis of what the student is "to learn to do," or perhaps we should say, "learn by doing." The course of study, therefore, should indicate what jobs or operations will be taught. It is equally important that the tools, the materials, and the machines which will be made available to the teacher and pupils, shall be designated. The necessity of including in a course of study a complete list of tools, materials, and machines, which are required to meet at least the minimum standards as outlined in the course of study, is obvious.

The Course — Predetermined

The course of study is first. So many times I have received requests for equipment lists from superintendents and laymen interested in setting up *some kind* of shop course. Seemingly, these men did not have the remotest idea of *what kind* of course they wanted to give. Just suppose it were to be woodwork. Is it to be for young boys in the sixth, seventh, and eighth grades, or for the older boys in the high school, or for adults in an evening-school program? As long as this illustration has been used, it might be well to point out that in a majority of cases, especially in smaller communities, it is necessary to equip a single shop for teaching more than one course. Each course to be taught must be analyzed carefully to determine just what tools, materials, and machines are to be used.

An Activity Analysis Necessary

An activity or job analysis must precede any intelligent request to set up equipment and supply lists. Then tools, materials, and machines can be purchased intelligently for the course under consideration. If the course is designed as a general industrial-arts experience in woodworking for boys in the sixth and seventh grades, then the nail hammers will be light, the crosscutting handsaws may have short blades, the nail sets may have small cups for small brads, and a junior-size plane will serve best. But just suppose the course is designed in carpentry for older boys, then the nail hammers must be heavier, the handsaws will have longer blades, the nail sets must be suitable for 8d finishing nails, and a heavy jack plane will be required.

Economical Utilization of Shop Space

Generally, it is necessary to teach more than one course in a shop. In many schools the younger boys, the high-school boys, and the adults will use the shop at different hours during the day and the evening. The question in regard to materials and equipment is, "What to do about it?" How can one determine what to do, what to buy? One obvious answer, but utterly foolish and terribly wasteful, is to buy three complete and separate sets of equipment, and lock up the equipment when not in use. An alternate method is to make a thorough activity analysis of each course to be taught in the shop, and list the tools, machines, and supplies required. Then "cross check" these lists so that there is no duplication. If new courses have to be scheduled from time to time, then an analysis of the new course will show what additional tools are necessary.

The activity analysis can be made to answer many questions in regard to the correct number of tools to be purchased. When manual training was first inaugurated, each workbench was equipped with a crosscutting handsaw, a ripping handsaw, a backsaw, a turning saw, a set of six chisels, a block plane, a jack plane, a ruler, a marking gauge, and a try-square. There was also a bench hook, to assist in

holding a piece for end planing or backsawing, at each bench.

One by one these tools have been removed from the individual workbenches and arranged in central tool cabinets or cribs. It was found, for example, that six backsaws in good condition, hanging in a central crib available to the student when required for use, were sufficient. Thus eighteen backsaws have been eliminated and a corresponding saving has been accomplished. This procedure has proved effective in any kind of shop, including general shops.

To recapitulate: Analyze the activities in each course; cross check the lists for the different courses and eliminate duplications; determine actual requirements, and don't purchase twenty-four tools when six will meet the needs.

Power Machines

Power-driven machines have a place in the practical-arts programs in our schools. Turning metal and wood, drilling holes, and grinding are common operations, and milling machine and the shaper are basic tools in the metalworking industries. However, these relatively simple machines have been developed and specialized to a degree almost beyond our comprehension. And what's more, every new industrial or mechanical development brings more specialized machines. Therefore, it is easily recognized that the schools cannot hope to instruct on the specialized machines in the school program, even in trade programs. What, then, are the school's limitations?

Budget Limitations

School-shop equipments are limited, in most cases, by the amount of money that is available. For purposes of discussion, therefore, it might be well to consider the number and type of power machines to be provided from that point of view. Machines are built in price ranges very much as are automobiles. Irrespective of the price paid, one can be assured that the manufacturer has placed into the machine all the accuracy and fineness of construction that he possibly can at that price. Competition guarantees that. The decision rests with the schools to decide just what quality of workmanship and finish are required for the instructional program.

Considerations of Weight and Size

Another troublesome question is the size or capacity of the machines which will be required for the instructional program.

One observation has been that a machine must be sturdy enough to resist misuse by young and careless learners. Either wood- or metal-turning lathes, for example, must be evaluated in terms of their sturdiness to resist misuse rather than by the size or capacity of any work that will be done on them. A small, exceedingly well built, precision machine may not serve the school as well as a sturdier lathe of less fineness of construction, even though the small lathe may be large enough to handle all the anticipated work that will be done in the school shop.

Years of Service Expected

The length of service that may be expected of any machine can be only a matter of conjecture. However, some school-shop machinery has been used for more than 40 years. Based on that experience, it may be assumed that good, durable machines can be expected to give 20 years of service with an ordinary amount of maintenance. Experience has also shown that lighter machines, costing half as much as those that are sturdier, will last less than half so long and require more repairs adjustments, and maintenance service during their shorter life.

The amount of money available for a new installation necessitates a decision that is difficult to make. For example, a John Doe lathe at $2,400 has the weight, size, and the fineness that makes a shop teacher or a real mechanic sure of the value. But the appropriation for lathes is $20,000. Then one must remember that "class size" is 30 pupils. Now, the question is, shall 8 work stations be provided, with $2,400 lathes, or shall 25 work stations be established, using $800 lathes? Shall the life expectations be set at 10 years, 15 years, or 20 years of service? If one arrives at a compromise decision, a reasonable middle ground may be reached. Furthermore, if you will keep your superintendent and board of education thoroughly informed concerning your policy, and the factors which influence your decision — verily, you will live happily with our machinery dealers and with your superintendent for a long time.

Obsolescence

Machines such as lathes, mills, shapers, saws do not become obsolescent so far as their purpose is to teach fundamental processes. Students being taught on old, belt-driven, exposed gear-box lathes need not be considered underprivileged so far as instruction in processes is concerned. But standards of safety for the operator have changed, and standards of economy of power have changed. Therefore, old lathes have had to be guarded according to modern standards; individual motor drives are often economical to install. New installations must meet modern standards of safety as to guards and methods of their power. Obsolescent! Yes, from the standpoint of modern safety! As to processes, and their practical application to teaching, No!

Specifications for Purchasing

Experience shows that it is best to do most of the buying through local dealers or distributors. Also, it will be found of great advantage to use materials, tools, and machines that are more or less in common use in one's own community. There are at least two reasons for this: (1) the dealer can move his own stock, and does not have to carry special items; (2) it serves educational purposes better to teach the use of articles that can be procured by students outside of the school.

Nomenclature

Standard catalog or trade nomenclature should be used in specifying materials and tools. This means that the exact name and description as found in good standard catalogs should be used. It should be a matter of professional pride that the industrial-arts teacher should know the correct name and specifications of the materials, tools, and machines that are used in his instructional program. Also, he should be familiar with standard packaging and accepted units of measure. It might be a dignity chaser if the industrial-arts teacher tried to buy a yard of packing when it is sold by the pound.

Similar and Equal

Competitive bidding is required for purchasing by many school systems. It would be quite impossible to set up a perfect system of purchasing, but it may be worth while to point out some of the practices that have been found of assistance in getting suitable merchandise and at the same time maintaining good relations with the various dealers who desire to sell to the schools.

1. Specify the quality so clearly that there can be no misunderstanding. In general, trade-marks and trade numbers will assist the buyer as well as the seller.

2. It will assist dealers if you are able to name by trade-mark and number more than two brands that are satisfactory, thus giving some opportunity for competitive price quotation.

3. Great care must be exercised that the alternates named are "similar and equal." It is unfair to designate articles as alternates that are not of equal grade. The school, however, has the right to be the judge, because list price is not always a reliable basis of value.

4. In the interests of economy, "first-grade materials" should not be specified unless that grade is required. For example, "second-class" files will meet nearly all school requirements.

5. As far as possible, refrain from naming some particular brand, and specifying "no substitute." This encourages paying excessive prices by killing competition.

6. Require samples whenever samples will assist in checking the quotations.

7. It has been found unwise for teachers and supervisors to make purchases. It is better for them to furnish the specifications to the board's purchasing agent, and to check bids in co-operation with him and have all purchases made by him.

Furnishing Supplies

The supplies — lumber, paint, metals, etc. — required for any authorized course of study are furnished by the Detroit board of education to all students. These supplies are sufficient to meet the essential or minimum requirements of any shop or laboratory course. Above these, students must purchase their own supplies.

Industrial-Arts Supplies for Grades 7 and 8

The following is a list of industrial-arts supplies for the seventh and eighth grades of the elementary schools.

Alcohol, No. 1 formula, shellac, 1 qt. per 200 stud. hrs. per term
Angle corner irons, 2 by 5/8-in. as needed
Art metal*
Blades, 12-in., turning saw, as needed; 18-in., turning saw, as needed; 10-in., hand hack saw, 1 doz. per 100 stud. hrs.; 6-in., keyhole saw, 2 per shop; 6-in., coping saw, 1 doz. per 100 stud. hrs.; 6½-in., coping saw, 1 doz. per 100 stud. hrs.
Bolts, ¼ by 3-in., stove, r.h., square nut, 1 doz. per 200 stud. hrs.
Brads, 5/8-in., No. 18, 1 lb. per 150 stud. hrs.; ¾-in., No. 18, 1 lb. per 150 stud. hrs.; 1-in., No. 17, 1 lb. per 200 stud. hrs.; 1¼-in., No. 16, 1 lb. per 75 stud. hrs.; 1½-in., No. 16, 1 lb. per 75 stud. hrs.
Brush, 1½-in., sash, 8 per shop
Buffing wheel, 6-in., cloth, as needed
Ceramics*
Checks, 1-in., brass, 200 per shop
Cotter pins, 1/16 by ¾-in. (box of 1,000), 1 box per shop
Cotter pins, 3/32 by 1-in. (box of 1,000), 1 box per shop
Cutter, emery-wheel dresser, 1 set, as needed
Envelope, 10 by 13-in., Kraft, 1 per pupil
Eraser, No. 444, 24 per room
Lesson sheets, 25 per room
Paper, co-ordinate (pad of 100 sheets), 1 pad per class — examination, 2 rms. per room; vertical lettering practice sheets (pad of 100 sheets): beginning, ½ pad per class; intermediate, 2½ pads per class; advanced, 1 pad per class
Pencils, 2H drawing, 24 per room
Scale, freehand lettering, 24 per room
Thumb tacks (box of 50), 3 boxes per room
Drill, 3/16-in., bit stock shank, 4 per shop; 7/32-in., bit stock shank, 4 per shop; 3/8-in., bit stock shank, 2 per shop; 1/8-in., straight shank, jobbers, 6 per shop; 3/16-in. straight shank, jobbers, 2 per shop; ¼-in., straight shank, jobbers, 2 per shop
Binding posts, No. 3 Fahenstack, 6 per shop
Dry cells, No. 6, 6 per shop
Fuse, 10-amp., screw plug, 6 per shop
Lamp cord No. 1S stranded, all rubber, brown, 1 ft. per 25 stud. hrs.
Staples (box of 100), 1 box per shop
Tape, ¾-in., friction, 1 roll per shop per term; ¾-in., rubber, 1 roll per shop per term
Wire, No. 14, rubber insulated, 1 ft. per 2 stud. hrs.; No. 26, copper, magnet, d.c.c., 1 lb. per 200 stud. hrs.; No. 18, bell, d.c.c., 1 lb. per 150 stud. hrs.
Emery cloth, No. 0 or 120, 1 sheet per 50 stud. hrs.; No. ½ or 90, 1 sheet per 75 stud. hrs.; No. 2 or 60, 1 sheet per 75 stud. hrs.
Fasteners, 3/8-in., No. 6 corrugated, (box of 100), 1 box per 400 stud. hrs.
File, 7-in., auger bit, 1 per room per term; 6-in., saw, extra slim taper, 2 per room per term; 6-in., round, second cut, 2 per room per term; 8-in., square bastard, 2 per room per term; 10-in., half round bastard, 2 per room per term; 10-in., hand smooth, 2 per room per term
File handle, medium size, as needed
Tanipaste, 2-oz. tube, 1 tube per shop per term
Faucet, ½-in., compression, 50 per shop per term; ½-in., fuller, 50 per shop per term
Glass cutter, 5-in., 4 per shop per term
Glazier points, No. 2 (¼-lb. box), 1 box per 200 stud. hrs.
Glue, liquid, hide, 1 pt. per 300 stud. hrs.
Grinding wheel as needed
Iron, blue annealed, 6 by 30-in., 20 gauge, 1 sheet per 15 stud. hrs.; 6 by 30-in., 24 gauge, 1 sheet per 5 stud. hrs.
Kerosene, 1 gal. per shop per term
Labels, No. 261, 4 boxes per shop per term
Leatherwork*
Linoleum carving*
Lumber*
Nails, 6d, smooth, 1 lb. box per 50 stud. hrs.; 8d, common, 1 lb. box per 50 stud. hrs.; 10d, common, 1 lb. box per 100 stud. hrs.; 6d, finishing, 1 lb. box per 50 stud. hrs.; 8d, finishing, 1 lb. box per 50 stud. hrs.; 5/8-in., No. 18 flathead, 1 lb. box per 150 stud. hrs.; ¾-in., No. 18 flathead, 1 lb. box per 150 stud. hrs.; 1-in., No. 17 flathead, 1 lb. box per 150 stud. hrs.; 1½-in., No. 16 flathead, 1 lb. box per 75 stud. hrs.
Oil, boiled linseed, 1 gal., as needed
Paint, black, 1 pt. per 150 stud. hrs.; blue, 1 pt. per 100 stud. hrs.; red, 1 pt. per 100 stud. hrs.; white, 1 pt. per 75 stud. hrs.; white (flat), 1 pt. per 75 stud. hrs.; yellow, 1 pt. per 50 stud. hrs.
Plugs, 2-prong (attachment), 6 per shop per term
Putty, commercial, 1 lb. per 50 stud. hrs.
Rags, white (washed), 1 lb. per 10 stud. hrs.
Resin, commercial, 1 lb. per shop per term
Rivet, 8-oz., tinners, 1 pkg. per shop per term; 1/8-in. diam. by 3/8-in., r.h. copper, 1 lb. per shop per term
Salammoniac, commercial, 1 lb. per shop per term
Sandpaper, No. ½, 1 quire per 150 stud. hrs.; No. 1, 1 quire per 100 stud. hrs.; No. 1½, 1 quire per 200 stud. hrs.
Screws, 5/8-in., No. 7 f.h.b., 1 gross per 200 stud. hrs.; ¾-in., No. 7 f.h.b., 1 gross per 200 stud. hrs.; 1-in., No. 7 f.h.b., 1 gross per 100 stud. hrs.; 1¼-in., No. 10 f.h.b., 1 gross per 100 stud. hrs.; 1½-in., No. 10 f.h.b., 1 gross per 50 stud. hrs.; 2-in., No. 11 f.h.b., 1 gross per 100 stud. hrs.; 2½-in., No. 11 f.h.b., 1 gross per 400 stud. hrs.; ¾-in., No. 7 r.h.b., 1 gross per 400 stud. hrs.; 1-in., No. 7 r.h.b., 1 gross per 200 stud. hrs.; 1¼-in., No. 10 r.h.b., 1 gross per 200 stud. hrs.; 1½-in., No. 10 r.h.b., 1 gross per 250 stud. hrs.; 2-in., No. 11 r.h.b., 1 gross per 200 stud. hrs.
Screw eyes, No. 114, 2 gross per shop
Screw hooks, No. 114, 2 gross per shop; No. 807, 1 gross as needed; No. 907, 1 gross as needed
Shellac, white, 4-lb. cut, 1 qt. per 150 stud. hrs.
Solder, wire, 1/8-in., diam., 1 lb. per 50 stud. hrs.
Soldering-copper points, 5/8-in., electric, as needed
Soldering paste, 1 lb. can per shop per term
Staples, ¾-in., galvanized, 1 lb. per 400 stud. hrs.
Tacks, 3/8-in. cut, blued, 1 lb. per shop per term
Tin, 20 by 28-in., bright, 1 sheet per 40 stud. hrs.
Turpentine, 1-gal. can, as needed
Twine, hemp, 1 ball per shop
Varnish, asphaltum, 1 qt. per 150 stud. hrs.
Washers, 3/16-in. flat, 1 lb. as needed
Wax, floor, 1 lb. per shop
Whiting, 1 lb. can per 200 stud. hrs.
Wire, No. 12 soft iron, 3 ft. per boy
Absorbent cotton, 1 roll per shop per term
Adhesive tape, 1-in. roll, 1 roll per shop per term
Ammonia, spirits of, 1 bottle per shop per term
Bandage, 2-in. gauze, 2 rolls per shop per term
Mercurochrome, 1 bottle per shop per term

The following is a list of equipment, tools, and supplies for an elementary-school shop in which seventh and eighth graders are instructed in household mechanics.

Bench, industrial-arts, complete with woodworking vises, 25
Cabinet, first-aid, 5 by 13 by 21 in., white, 1; supply (for paint storage), steel, 72 by 36 by 18 in., 4 shelves, locking doors, 1
Locker, steel, 72 by 12 in., 1 door, 24 divisions, 6 by 6 in., special, as needed
Awl, scratch, 4; brad, tucks riveted, 4
Bell, electrical, 2½-in., 4
Bench stop, shank to fit bench, 25
Bevel, T, 8-in., 1
Bibb, ½-in., compression, 2; hose, ½-in., compression, 2
Bit, auger, 4/16-in., 5/16-in., 6/16-in., 8/16-in., 10/16-in., 11/16-in., 12/16-in., 14/16-in., 16/16-in.; 2 each; countersink, ¾-in., rose type, 2; screw driver, 5/16-in., 3/8-in., 1 each
Block, pounding, 2 by 8 by 12-in., 50-lb., 2
Brace, bit, 10-in. sweep, nonratchet, 3; 10-in. sweep, ratchet, 1
Brush, bench or counter, 8-in., 2¾-in. bristles, 25
Butt, 1½ by 1 7/16-in., loose pin, bright steel, 4; 3 by 3-in., ball-tipped pin, 4
Buzzer, electrical, 2
Can, oily waste, 12 by 15-in., galvanized, with legs and spring cover, 1
Can opener, 1
Carving tool, 1/8-in. veining, 1
Ceramics*
Chisel, 1/8-in., ¼-in., socket firmer, butt, beveled edge, 2 each; ½-in., 1-in., socket firmer, butt, beveled edge, 4 each; ¾-in., cold, 2
Clamp, C, 2-in., 4-in., 6-in., ball-and-socket tip, 2 each; cabinet, 2½-ft., 4-ft., 2 each
Cock, sill, ½-in. compression, 2; basin, ¼-in. compression, 2
Compass, pencil, 2
Cupboard catch, 1⅜ by 1⅞-in., cast iron, brass finish, 2
Die, pipe, 1/8-27 Am. std., 1-in. round, adjustable, 1; machine screw, 5-40 N.C., 6-32 N.C., 8-32 N.C., 10-24 N.C., 1-in. round adjustable, 1 each; fractional, ¼-20 N.C., 5/16-18 N.C., 3/8-16 N.C., 1-in. round, 1 each
Die stock, to hold 1-in. round adjustable die, 1
Divider, blackboard, 18-in., 1; wing, 6-in. swing, woodworking, 4; wing 10-in. swing, hardened and polished, 1
Dresser, emery wheel, 1
Drill, bench, 0–½-in. chuck capacity, hand power, 1; hand, 3/8-in. chuck and set of drills Nos. 1 to 8 or 1/16 to 11/64-in., 1
Figures, 3/16-in., machine cut, set of 9, 1 set
File card, file cleaner with scorer, 4
Fuse block, 2-circuit, 30 amp., 2
Gauge, marking, wood, without graduations, 25
Goggles, clear, grinding, 4 pr.
Gouge, outside bevel — 3/8-in., 1; 5/8-in., 1-in., 2 each; inside bevel, ¾-in., 1
Grinder, bench, electric, 6-in., 110-volt, 60-cycle, a.c., motor contained, 1
Hammer, machinist, 24-oz., ball peen, 2; nail, 16-oz., adze eye, 1; nail, 7-oz., adze eye, 6; planishing, 12-oz., with handle, rectangular, domed face, 2
Hasp, safety, 4½-in., with staple, 1
Hatchet, shingling, 16-oz., steel, 1
Hinge, ornamental, 2⅜ by 2-in., wrought, 2
Knife, putty, 1¼ by 3⅝-in. blade, 4; scoring, 2½-in. blade, Sloyd, 6
Leather*
Lift, window sash, 4-in. length, 2
Linoleum carving*
Lock, window sash, wrought steel, 2
Lock set, mortise, 4
Mallet, wood, No. 1½, hickory, 4
Mechanical drawing*
Miter box, complete with 24 by 4-in. backsaw, special
Nail set, 1/16-in., diameter, 2
Nippers, cutting, 10-in. length, 1
Oilstone, 8 by 2 by 1-in. combination, 1; slip, 4½ by 2⅛ by 5/8 by 5/16-in., 1
Oiler, 5-oz., steel, 3-in., straight spout, 2
Padlock, combination, 4
Plane, block, 7-in. length, 1⅝-in. cutter, adjustable, 2; jack, 11½-in. length, 1¾-in. cutter, 25
Plane iron, double, 1¾-in. cutter, 12
Pliers, side-cutting, 8-in. length, 6
Pulley, window, 2-in. wheel, 4⅜ by 1-in. faceplate, 4
Punch, center, ½-in. body, 5½-in. length, 1
Push button, entrance, round, 6
Receptacle, electrical, 4 by 1 by 2¼-in., porcelain, cleat type, 6
Rivet set, No. 7 for 1 to 1¼ lb., iron rivets, 2
Rule, 12-in. steel, 25
Saw, back, 10-in. length, 12; coping, 6½-in., 25; hack, 8–12-in., hand, adjustable frame, 1; crosscut, 22-in. length, 10-point, 4; rip, 24-in. length, 7-point, 4; jeweler's, 5-in. depth of frame, adjustable, 4; keyhole, iron handle, 1; turning, 12-in. length, 1
Scraper, cabinet, 5 by 2½-in., rectangular (blade only), 3; 5 by 2½-in., convex and concave ends (blade only), 1

*A standard list of equipment and supplies is on file in the vocational-education department.

*A standard list of equipment and supplies is on file in the vocational-education department.

Screw, hand, 10-in., 12-in., 4 each
Screw driver, 3-in., 6-in., 4 each; 6-in., 2; 8-in., 1
Snips, tinners, 2-in. curved cut, 1; 2-in., 3-in., straight, 2 each
Socket, lamp, 2-way plug, keyless, chain pull, push-through switch, 2 each
Soldering copper, 5/8-in., electric, 2
Spokeshave, complete, 6
Square, framing, 24-in. rafter, 1; try, 6-in. blade, 25–12 in. blade, 1
Stake, planishing, large and small, 1 each
Switch, snap, 5-amp., 125-volt, 3-point, 2; 2-point, 3
Transformer, bell, ringing, 110-volt, 60-cycle, primary, 8-volt secondary, 2
Vise, machinist's, 4-in. jaw, 1
Wrench, monkey, 10-in., knife handle, 1; pipe, 10-in., steel handle, 1

Mechanical Drawing

Compass, pencil, 12
Drawing board, 16 by 21-in., 25
Scale, flat, 12-in., 12
Triangles, 45–90-deg., 6-in. celluloid, 12; 30–60-deg., 8-in. celluloid, 12
T squares, 24-in. maple, 12

The Industrial-Arts Budget and Its Operation

Roy R. Van Duzee

Supervisor of Industrial Arts, Public Schools, West Allis, Wisconsin

A system of budgeting worked out for the city of West Allis, Wisconsin.

In many industrial-arts departments the teachers and supervisors have little budget responsibilities beyond accounting for supplies expended and making requests for supplies and equipment from time to time. The department may operate under a budget which is loosely adhered to, and which has little or no relation to the function and aims of the school. In school as in business the well-considered budget, carefully followed, is an important factor in making it possible to achieve the aims set up. This is particularly important in those kinds of schoolwork which make use of considerable equipment and a variety of supplies not used in academic work. Budgetmaking and its operation as it is practiced in the city of West Allis makes for an effective use of public money, because department heads can plan for use available money in an intelligent manner.

The budget plan used is based on the idea that (1) the persons who are responsible for expenditures should be consulted in making the budget, (2) money within the ability of the people to furnish it will be allocated for definite purposes under an approved plan, (3) when money is set aside for a certain use it must be spent for that purpose and no other except under approved transfer from one account to another and (4) that the total sum allocated to a department will be available for the department's use. The ideas controlling budgetmaking and its operation in the above plan place considerable responsibility on every person who operates under it as it requires planning under definite aims, and since allocation of funds within a department is made, each teacher is limited to running his shop according to funds set up for his shop. Due to the fact that funds not spent by the end of the fiscal year are carried over for use in the department, hasty and ill-considered purchasing is not necessary.

Budgetmaking is a continuous process. As plans are conceived requiring money, the needs are immediately noted. By the end of the school year in June each teacher submits to the supervisor an itemized, priced list of needs according to the school plan for the ensuing budget with a justification for items of unusual nature, either because of the large amount of money involved or because the item is based on a change in policy or in shop operation. The listings follow the board-of-education accounting plan. In case of industrial arts, the accounting numbers are 29–7 industrial-arts office supplies, 35–7 free books, 36–7 supplies used in instruction, 54–7 repairs and replacements, and 67–7 new equipment for old buildings. In addition to the numbers given above, a number indicating the school is required which identifies the money with a particular school. For instance, an account number 36–7–1 indicates supplies needed by the industrial-arts department of the senior high school. In the event that a shop in a new building is planned a separate list is prepared for the superintendent by the supervisor. Teacher lists are based on aims, shop policies, offerings in the shop, activities carried on in the shop, and number of pupils to be provided for. Since the budget affects what can be done in the shop for a year, much serious thought is devoted to the lists prepared by the shop teacher.

During the first ten days of the school year the tentative departmental budget is made up from the teacher lists. The idea is to furnish the superintendent with a budget that can be justified as necessary and reasonable. New aims, plans, and policies affecting the tentative budget are prepared as an aid to the superintendent in the consideration of the tentative budget. When the departmental requests are incorporated into the school budget, the supervisor is called to confer with the superintendent and the tentative budget is gone over item by item. It is at this time that the opportunity arises to discuss purposes, new offerings, and policies affecting the entire department. On the basis of the requests and the facts gleaned from the conference, the superintendent puts into the tentative school budget the amount of money he believes necessary for the department, and which he can reasonably ask for.

A copy of the portion of the industrial-arts tentative budget for 1938 follows. Figure 1 is the summary sheet. Figure 2 is the sheet covering supplies.

The superintendent sends to each principal and department head a statement showing the amount of money allocated to the school or department for the year. The budget for the year 1938 is shown in Figure 3. On the basis of money allowed the department, a departmental budget by teachers and shops is prepared. The 1938 budget showing the disposition by shops and teachers is shown in Figure 4. It will be noted that the tentative budget submitted to the superintendent and the final departmental budget do not agree, but that the budget statement and the final departmental budgets do agree. Shop collections for supplies are credited to the industrial-arts supply fund. This credit would raise the $1,310 allowed for supplies by the board of education to $2,880 as set up in the final departmental budget for supplies.

Mention was previously made that if new shops were to be provided for in the tentative budget, a separate list would be furnished the superintendent. The preparation of this statement requires very careful thought and exhaustive study. Proper planning at this time affects what may be done in the shop for many, many years. The time to equip a shop is when the building is being originally equipped. It is more difficult, as a rule, to add to equipment later, than it is to get the equipment at the time the building is equipped.

When a new building is to be built in West Allis, the superintendent asks principals and supervisors involved in the building program, to submit a list of what is needed. The needs have to do with building space and equipment for the building. These needs must be based on a re-examination of the school philosophy and the purpose of industrial arts which is to be offered in the new shops. Requests for building space and equipment for the industrial-arts shops are based on: (1) The activities which are to be provided for in the shop, i.e. (electrical work, general metal and machine-shop work), (2) the

WEST ALLIS PUBLIC SCHOOLS
West Allis, Wisconsin

BUDGET STATEMENT
Summary

School or Department Industrial Arts Year 1938

Classification Number	Classification Description	Dept.	School	Items	Amount
29-7-143	Office supplies	Ind. Arts	Sr. and Jr. High Schools	As listed	$ 75.00
35-7-4	Textbooks	Ind. Arts	Horace Mann Jr. High	As listed	10.00
36-7-143	Supplies	Ind. Arts	Sr. and Jr. High Schools	As listed	2,910.00
54-7-143	Replacements and repairs	Ind. Arts	Sr. and Jr. High Schools	As listed	1,439.43
67-7-143	New equipment	Ind. Arts	Sr. and Jr. High Schools	As listed	17,211.36
	Grand total for tentative budget				$21,645.79

Fig. 1

WEST ALLIS PUBLIC SCHOOLS
West Allis, Wisconsin

BUDGET STATEMENT

School or Department Industrial Arts Year 1938

Classification Number	Classification Description	Dept.	School	Items	Am't
37-7-1	Supplies	Ind. Arts	High School	Drafting	$ 40
"	"	" "	" "	Printing, duplicating	75
"	"	" "	" "	Woodwork	450
"	"	" "	" "	Auto mechanics	
"	"	" "	" "	Junk parts and hauling	200
"	"	" "	" "	shop supplies	
"	"	" "	" "	Metalwork	350
"	"	" "	" "	Electrical work	75
36-7-4	"	" "	Horace Mann	General woodwork and	
"	"	" "	J. H. S.	electrical	300
"	"	" "	" "	Duplicating & drafting	85
"	"	" "	" "	General metal	350
36-7-5	"	" "	Nathan Hale	General woodwork	
"	"	" "	J. H. S.	electrical & drafting	350
"	"	" "	" "	General metal work and	
				electrical work	300
36-7-6	"	" "	John Dewey	Duplicating	50
"	"	" "	J. H. S.		
"	"	" "	" "	Drafting	10
"	"	" "	" "	Woodwork	100
"	"	" "	" "	Electrical work	75
"	"	" "	" "	Metalwork	100
				Grand Total	$2910

Fig. 2

West Allis Public Schools
West Allis, Wisconsin

Harry H. Nash
Superintendent

December 15, 1937

Mr. R. R. VanDuzee
Industrial Arts Supervisor
West Allis Public Schools
West Allis, Wisconsin

Dear Mr. VanDuzee:

The following represents your budget for the fiscal year of 1938. The budgets as approved by the Board will be so set up in the office of the City Auditor and no order will be consummated unless funds are available under the budget number. It will thus be seen that it will be absolutely necessary for you to stay within the limits of your budget. Budget numbers must always appear and items requested must be kept strictly within their budget classification. It is, of course, possible to make transfers but before I recommend any transfer to the Board there must be established a real need or reason as to why you wish the transfer to be made.

29-7	Office supplies	$ 75.00
35-7	Free textbooks	10.00
36-7	School supplies	1310.00
54-7	Repairs and replacements	862.43
67-7	Instructional equipment and apparatus	3279.76
	Total	$5537.19

Very truly yours,

H. B. NASH
Superintendent of Schools

HBN:LS

Fig. 3

WEST ALLIS PUBLIC SCHOOLS

INDUSTRIAL ARTS DEPARTMENT

1938 Budget

School	29-7	35-7	36-7	54-7	67-7	Total
General						
Ind. Arts Office and Free Texts	75.00	10.00				85.00
High School						
Drafting.....Mr. Erickson			30.00	50.00	20.00	100.00
Woodwork.....Mr. Byerly			435.00	55.53	110.00	600.53
Print Shop.....Mr. Sturm			100.00	150.00	210.30	460.30
Auto Mechanics....Mr. Hughes			135.00	70.00	200.00	405.00
Metal Work.....Mr. Stone			500.00	68.50	650.00	1218.50
Electrical Work...Mr. Knoblauch			135.00	249.00	422.46	806.46
Horace Mann						
General Woodwork..Mr. Jackson			300.00	50.00	55.00	405.00
Electrical Work...Mr. Jackson						
Duplicating.....Mr. Jungck			100.00	25.00	100.00	225.00
Drafting.....Mr. Ferguson			15.00	25.00	40.00	80.00
General Metal.....Mr. Ferguson			200.00	12.40		212.40
Nathan Hale						
General Woodwork..Mr. Schoenike			325.00	50.00	1400.00	1775.00
Duplicating.....Mr. Schoenike						
Drafting.....Mr. Schoenike						
General Metal.....Mr. Froelich			270.00	32.00	72.00	374.00
Electrical Work...Mr. Froelich						
John Dewey						
Duplicating.....Mr. Rose						
Drafting.....Mr. Rose			10.00	25.00		35.00
Woodwork.....Mr. Rose			125.00			125.00
Electrical Work...Mr. Price			75.00			75.00
Metal Work.....Mr. Rose			125.00			125.00
TOTALS	75.00	10.00	2880.00	862.43	3279.76	7107.19

Fig. 4

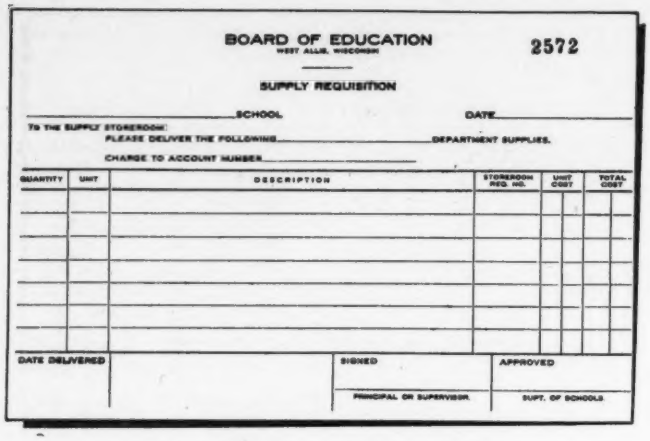
number of students to be handled at one time and their distribution in various types of work in the shop, (3) the area needed for machines, bench equipment, and tools, and the like and (4) the shop arrangements and layout for the work such as, space around equipment, washstands, toolroom or tool panels, storage space in benches and in cabinets, work stations, electric outlets for lighting and power, gas outlets, air lines, display and bulletin boards, seating arrangement, blackboard space, teacher desk, files, and the like. The requests for the new building include a preliminary shop layout, itemized lists for each shop under such classification as, benches, machine tools, hand tools, and instruments. The amount of money set up for the new equipment is set up on the school-board books in the same manner as it is set up for the regular yearly budget.

Industrial Arts Department - Auto Mechanics
From Jan. 1938 through June 1938

		Order Number	36-7			$135.25	54-7			$70.22	67-7			$200.25
Jan. 21	Linde Air Products Co.	9656	10	00	10	00	124	20						
Jan. 21	Wilbur Lumber Co.	9651					7	25	7	25	62	75		
Jan. 21	Miller Automotive Trade	9655	21	00	31	00	103	20						
Dec. 21	Shadbolt + Boyd	9491											93	30
Feb. 24	Supply Dept.	2554	7	31	39	11	95	69						
Mar. 9	Supply Dept.	2563	5	15	44	96	90	04						
Mar. 11	Linde Air Products Co.	9656	1	16	46	12	88	80						
Mar. 23	Supply Dept.	5975	4	88	51	00	14	00						
Mar. 23	Wisconsin Lath Bureau	132											10	00
Apr. 12	Supply Dept.	3546E	6	07	57	07	77	73						
Apr. 13	Shadbolt + Boyd	Order number							7	50	14	78	55	25
Apr. 6	Bruce Publishing Co.	246												
May 11	Supply Dept.								11	30	26	12	43	08
		549							13	00	31	92	30	08
June 7	Chas. Hilgendorf + Co.	548							9	54	41	46	20	54
June 9	Chas. Hilgendorf + Co.	557												
June 9	Shadbolt + Boyd	555												
					93	14	40	77			47	46	20	54

Fig. 5

Since it is necessary for the supervisor to keep strictly within funds allotted and for teachers to do the same, office books are kept. The record covers expenditures by account numbers on a control sheet for



BOARD OF EDUCATION
WEST ALLIS, WISCONSIN

2572

SUPPLY REQUISITION

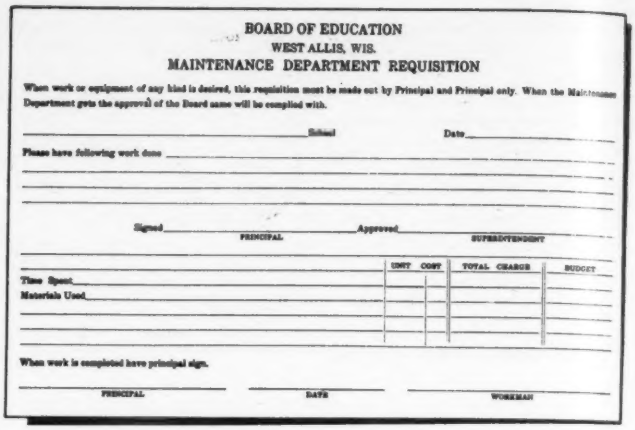
_____SCHOOL. DATE_____

TO THE SUPPLY STOREROOM:
PLEASE DELIVER THE FOLLOWING_____DEPARTMENT SUPPLIES.
CHARGE TO ACCOUNT NUMBER_____

QUANTITY	UNIT	DESCRIPTION	STOREROOM REQ. NO.	UNIT COST	TOTAL COST

DATE DELIVERED | SIGNED (PRINCIPAL OR SUPERVISOR) | APPROVED (SUPT. OF SCHOOLS)

Fig. 7. This form comes in triplicate



BOARD OF EDUCATION
WEST ALLIS, WIS.
MAINTENANCE DEPARTMENT REQUISITION

When work or equipment of any kind is desired, this requisition must be made out by Principal and Principal only. When the Maintenance Department gets the approval of the Board same will be complied with.

_____School Date_____

Please have following work done _____

Signed_____ PRINCIPAL Approved_____ SUPERINTENDENT

	UNIT COST	TOTAL CHARGE	BUDGET
Time Spent			
Materials Used			

When work is completed have principal sign.

_____ PRINCIPAL _____ DATE _____ WORKMAN

Fig. 8

Secretary's Copy

BOARD OF EDUCATION
West Allis, Wisconsin
PURCHASE ORDER REQUISITION

DATE _____
Order of _____ PURCHASE ORDER NO. _____
Located at _____ BUDGET NO. _____
Deliver material as specified below DEPARTMENT _____
Ship to _____ SCHOOL _____
Shipping Address _____
For _____

Quantity	Unit	Catalogue Numbers, Names and Descriptions	Unit Price	Total

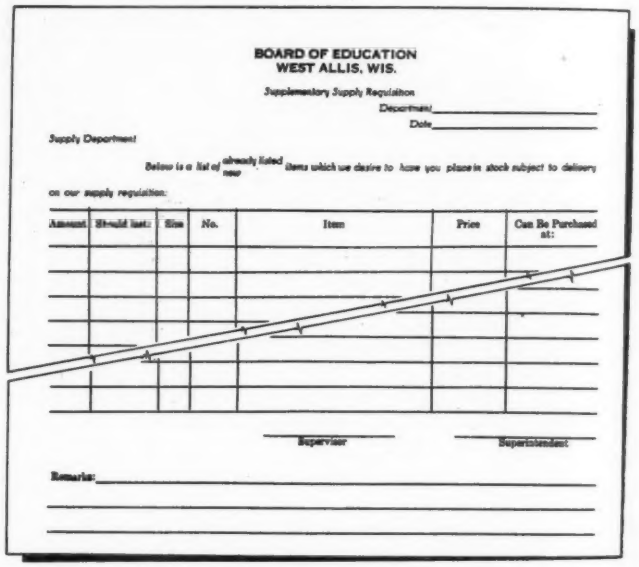
Address all invoices and correspondence to Superintendent of Schools
7310- W. National Avenue, West Allis, Wisconsin
Bill must be made out on our form and will not be accepted unless AFFIDAVIT IS SIGNED.
Shipping documents, invoices and packages must show our purchase order number and your name, and be mailed immediately on shipment.
Delivery must actually be effected in accordance with this order unless otherwise arranged for in writing.
Settlements are made at the first regular meeting of the Board on all claims in the above stated office on the 25th day of the month previous.
All material received is subject to final acceptance and approval by the Board of Education.
Shipment to be made according to quotation. If no quotation is made, unless otherwise stated, ship by cheapest way possible.

APPROVED _____ _____ _____

Budget _____ Signed: _____ Dept. Head or Supervisor
Exp. to date _____ _____ Superintendent
Balance _____ _____ Comptroller
_____ Secretary

Date introduced _____ 19__
Passed _____
First note on _____

Fig. 6. This form comes in quadruplicate. Copies intended for secretary, firm, superintendent, and department



BOARD OF EDUCATION
WEST ALLIS, WIS.

Supplementary Supply Requisition
Department _____
Date _____

Supply Department

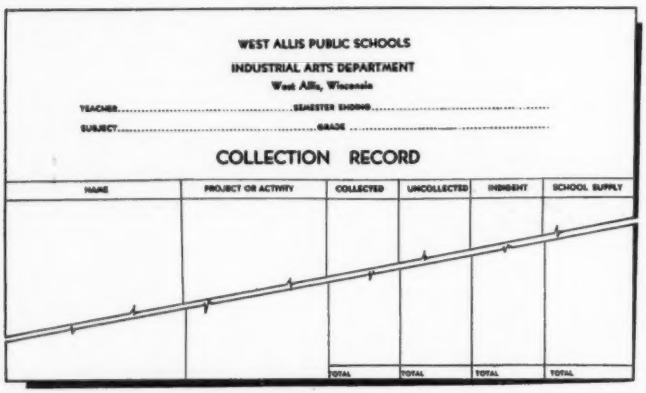
Below is a list of already listed / new items which we desire to have you place in stock subject to delivery on our supply requisition:

Amount	Should last:	Size	No.	Item	Price	Can Be Purchased at:

_____ Supervisor _____ Superintendent

Remarks: _____

Fig. 7A. This form comes in duplicate



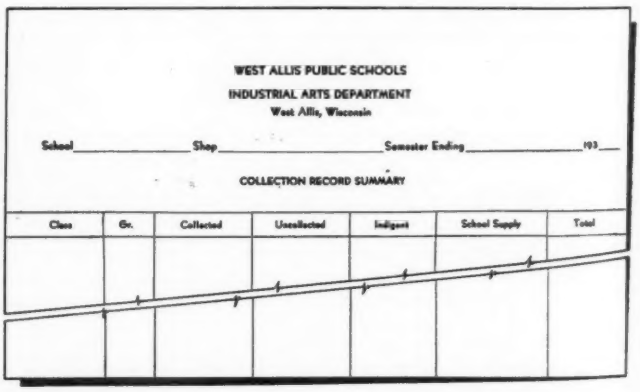
WEST ALLIS PUBLIC SCHOOLS
INDUSTRIAL ARTS DEPARTMENT
West Allis, Wisconsin

TEACHER_____SEMESTER ENDING_____
SUBJECT_____GRADE_____

COLLECTION RECORD

NAME	PROJECT OR ACTIVITY	COLLECTED	UNCOLLECTED	INDIGENT	SCHOOL SUPPLY
		TOTAL	TOTAL	TOTAL	TOTAL

Fig. 11



WEST ALLIS PUBLIC SCHOOLS
INDUSTRIAL ARTS DEPARTMENT
West Allis, Wisconsin

School_____ Shop_____ Semester Ending_____ 193__

COLLECTION RECORD SUMMARY

Class	Gr.	Collected	Uncollected	Indigent	School Supply	Total

Fig. 12

the department and expenditures by teachers under each account number. Figure 5, showing a teacher account, illustrates the way the record works out in an auto-mechanics shop. This same kind of record is kept for the control sheet for each account number.

Expenditures may be made against the departmental budget in four ways: (1) Purchase-order requisitions (see Fig. 6), (2) supply requisitions (see Fig. 7), (3) maintenance requisitions (see Fig. 8), and (4) cash memo slips (see Fig. 9). All requests are initiated by the person responsible for the accounts against which the

charge is to be made and all requests must have the approval of the superintendent.

Purchase records cover requests for equipment and supplies not in the school standard supply list. These requests after receiving the approval of the superintendent are sent to the comptroller. If there are funds in that particular account, the comptroller signs the request. A copy of

MEMO SLIP
PETTY CASH FUND

Budget No.	Item	Cost

Rec'd Payment _____ Approved: _____

Fig. 9

the requisition if approved by the board of education, is sent to the bookkeeper who makes the proper deduction on the records.

Supply requisitions and maintenance requisitions after receiving the approval of the superintendent are sent to the maintenance department, which purchases and delivers supplies on the standard supply list and does the work covered in the maintenance requests. Each month the maintenance department sends a statement to all persons in charge of departmental accounts which shows all charges made. The statement shows the order number, to whom the material was sent or for whom the service was rendered, amounts charged and account numbers affected.

Cash memos are used for emergency purchases and are obtained from the superintendent. Upon showing receipted bills for purchases made, the money spent is refunded. These amounts are also charged to the proper departmental accounts.

Each department, at the end of each month, receives a budget statement from the board of education (see Fig. 10). It

WEST ALLIS PUBLIC SCHOOLS
Budget Statement Month Ending November 30, 1938

Acct No.	Appropriation	Expended this mo.	Expended to date	Cash balance	Unpaid encum.	Avail. balance
29-7	79.38	3.94	42.08	37.30	1.00	36.30
35-7	76.75		2.50	74.25	34.41	39.84
36-7	1727.79	348.58	1010.44	717.35	342.71	374.64
54-7	1107.31	10.32	681.93	425.38	167.07	258.31
57-7	4616.44	140.25	1837.69	2778.55	463.71	2314.84

Fig. 10

shows the account numbers, amount appropriated under each number, amount expended during the current month, amount expended to date, cash balance, unpaid bills and available cash balance. This statement and the control sheet in the industrial-arts office must balance. Balances in the several teacher accounts are available to the shop teachers. They know how much money they have to work with for the year and the amount available for the remainder of the year. Reference to Figure 5 shows entries made due to expenditures from school purchase order requisitions, maintenance requisitions, supply requisitions, and cash memo slips. When a charge is made the amount spent to date and available balance is set down.

Students are required to pay for supplies used by them. In some shops a fee is charged while in other shops bills are kept. Fees and deposits are collected at the beginning of the semester. Collections are reported to the supervisor on forms for that purpose (see Figs. 11 and 12). The collection record carries the name of every student enrolled in the class for the semester and the amount of money collected from each student and for what the collection was made. The several collection reports are consolidated in the collection record summary. Money received from teachers then is sent to the board of education.

Supplies used in authorized schoolwork are reported on the school supply record (see Fig. 13). At the end of the fiscal school year account is taken of the amount of money collected in each shop, and the amount of money expended in authorized schoolwork in each shop. A comparison can be made for each shop between the amount spent for supplies during the year by the board of education, and the amount of money collected for supplies in each shop.

WEST ALLIS PUBLIC SCHOOLS
INDUSTRIAL ARTS DEPARTMENT
WEST ALLIS, WISCONSIN
SHOP_____ SEMESTER ENDING_____ 19____
SCHOOL SUPPLY RECORD

Job No. or Person	Job Description	Stock Description	Amount	Cost

Fig. 13

Budgetmaking and its administration and operation are co-operatively carried on in West Allis between the school, the board of education, and the city council. The present plan which operates very well has come about through improvements and changes over a period of years. It helps clarify the purposes of the work, aids in providing for adequate facilities to carry on the work, and calls for the proper accounting for funds used in running the shops.

What of Our Graphic-Arts Equipment?

Harold H. Kirk
Langley Junior High School, Washington, D. C.

The students in our shops today are living in a different age from that which existed 25 years ago. Ours is a period of more rapid change — economically, industrially, and socially. Many factors new to all of us, are influencing them, directing, and determining their environment. Orientation is more difficult; greater demands are made upon the time there is for adjustment. A greater variety of things are expected of the individual than ever before.

Is printing in our secondary-school shops keeping abreast of these rapid changes? Are our courses of study in our junior and senior high schools providing for adequate exploration, tryout, and adjustment? Is our printshop equipment adequate in terms of pupil needs?

Implementing for greater activity in the graphic arts is necessary if we are to keep pace with life outside the school shop.

Printing As It is Found in Schools

Printing as an industrial-arts subject is comparatively new. In many parts of the country it is still, broadly speaking, a *prevocational* shop course. For the most part, the instructors are teaching what they were taught. The philosophy is still that of manual training. In fact, in some

cities, printing is still officially titled *manual training*, and the instructors continue to be *manual-training teachers*.

And the printshops themselves? They are for the most part, according to recent surveys, still poorly lighted, unsystematically arranged and housed. The equipment installed, except in rare cases in new buildings, is purchased ahead of a planned course of study. The philosophy as to what is best for the individual boy, or the relation of the layout to his physical, occupational, or social needs, has been but slightly considered. It has been found that very few see the printshop as a working laboratory for all phases of the graphic arts for experimentation, hobby outlets, and the acquisition of handicraft skills.

As has been said, printing, being relatively new as an industrial-arts subject, has made no exacting research or testing to check its progress. Because of this, to most people it is still a printshop where youngsters are trained to use their hands a little, keep out of trouble, and turn out sundry jobs for the school. In considering printing, the public usually thinks of it as typesetting and press feeding, which is actually only a small part of the relief printing trade. Little else has been introduced, especially in our junior high schools. Over 50 per cent of the shops are teaching the subject as it was introduced after the world war, as vocational training. Until recent surveys had been made, little of the new trends was known; few suspected the limitations of present courses and equipment until research began to reveal inadequate conditions.

Printing As an Industrial-Arts Subject

What do we mean by printing as an industrial-arts subject? This type of printing "is a phase of general education that concerns itself with materials, processes, and products of manufacture and with the contributions of those engaged in industry."[1]

And to quote further, we learn that industrial arts is "a study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to those changes"[2] — which is really the aim of any *subject* in general education.

These definitions presuppose an all-inclusive word to title our subject. It is obvious that the word *printing* is limited in meaning and content. In our field, then, graphic arts would be the phrase to include the whole area, its materials, processes, and products. It means more than the acquiring of skill in sticking type and feeding press; it means knowing something of the whole industry in light of our industrial society. In senior high school it means sampling a great variety of the graphic-arts processes; in junior high school it means exploration for individual orientation.

[1]U. S. Bulletin 34, *Industrial Arts, its Interpretation in American Schools*, 1938, p. 1.
[2]*Ohio Prospectus*, 1935, p. 51.

A Challenge to Status Quo

Of the 141,000 individuals taking courses in printing in our secondary schools, 90,000 are in junior high schools and 51,000 are in senior high schools. Of this whole amount, less than 3 per cent are becoming printers. Doesn't it seem apparent then that there is a fallacy to be teaching for vocational training in junior and senior high school when so few enter the trade? Isn't it rather shortsighted to continue to purchase equipment for the teaching of a small phase of one of our largest industries? According to these recent figures,[3] it has been found that there are only 10,000 boys in trade and technical schools. Why should a small, minority group dominate, equip, and set up the courses of study for the entire secondary-school graphic arts?

The graphic arts have had their greatest growth in our secondary schools. It seems only natural that their future then should be determined by research and development by men in this field.

If it is the job of industrial-arts instructors to prepare boys to understand something of the place of graphic arts in their lives and to effectually teach them how to take part in an industrial world, we must become cognizant of trends in curriculum construction and provide research on which to base a program. We must provide equipment that will aid us in training for living rather than training for vocational skills entirely. Dr. Stephen E. Kramer, the late assistant superintendent of schools, Washington, D. C., realized some time ago that strict adherence to standards alone tends to neglect the individual, for he said: "The modern objective of public education is equal educational opportunity for all of the children of all of the people."[4]

In light of the equipment found in a large percentage of the junior- and senior-high-school shops, is it possible to carry on an adequate diversified activity program? With large groups, especially in unit shops in our industrial cities where we find undemocratically large classes, is it possible for 35 or 40 boys to use one proof press successfully and safely? Are we providing "equal educational opportunity" for all? Is it profitable for the school board to purchase a $475 proof press for industrial-arts courses in printing when two proof presses, costing approximately $60 and $125 each will do the job better and safer?

Will the equipment offered help the youngsters find themselves in our complex industrial society? All phases of the graphic arts are a part of our everyday lives. Can we demonstrate samplings of these processes to our classes with present equipment? Manufacturers will provide the correct equipment whenever they have been informed as to what is needed.

Have we not fallen short in our job if we have given the boys so little that it fails to influence them to carry on their interests beyond their shop experience of sticking type. And how can a boy ever maintain his interest and carry on worthwhile work if he is one of twenty or thirty trying to pull a proof on the same proof press? This is actually true in several of our large industrial cities. How long can educators continue to blame the pupil when he isn't given full opportunity and time for individual experimentation?

Therefore, it would seem equipment should be purchased with the thought in mind as to what the instructor is expected to produce and turn out of his shop. Purposes, too, should be analyzed more carefully to see wherein we can implement for greater activity even with the present equipment.

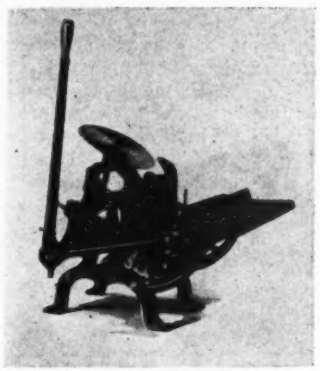
[3]1937–38 survey made by the National Graphic Arts Education Guild, unpublished as yet.
[4]"The Public School and Industry," *Printing Education*, Nov., 1932.

Which Kind of Equipment is Needed?

The average annual cost of instructional materials for junior high schools is $124 to $137 per year; in senior high schools, it is about $207. Is this amount going for the maintenance of *status quo* or is it providing for a greater activity program?

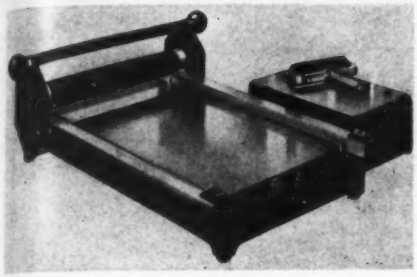
Do we need large, expensive, and often obsolete equipment, when vocational training is not the objective of the course of study? In a recent survey of 1,600 courses of study from schools in several states, it was found that 69 per cent were teaching a set of objectives instead of preparing materials and processes to meet changing pupil needs.

In terms of equipment, what can we do about equality of opportunity? Can we teach 25 or 30 boys press-feeding skill with one 12 by 18-in. platen press? What about supplementing with two or three 6½ by 10-in. pilot presses as a means of facilitating greater opportunity and practice? They will cost approximately $80 each, and at about one fourth the cost of one 12 by 18-in. platen. Three of them will accommodate 6, eight, or even 10 boys. Again, money is saved and pupils' needs have been considered and improved.



The pilot press, 6½ by 10-in. chase

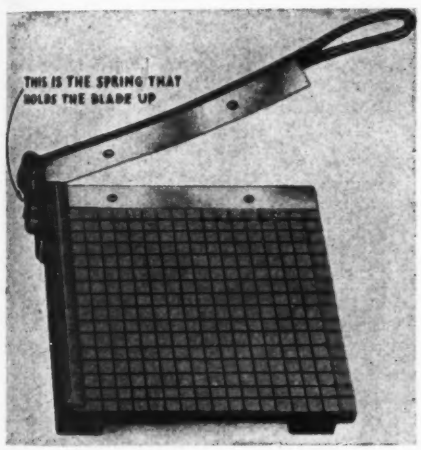
And again, why can't school posters and other large jobs be made by the silk-screen process, instead of using an expensive proof press with expensive types? Besides, in experimenting with the silk-



An inexpensive, practical, and safe proof press for the graphic-arts shop

screen process, the boys are learning another phase of the graphic arts.

Why can't a greater part of the school office forms be run off on a multilith? It would provide a means for teaching the history and theory of lithography, one of the three methods of duplicating. The cost of this machine is down considerably now and well within the range of the junior-high- or senior-high-school shop budget. Since this machine is an important one in our everyday business life, why shouldn't it be included in graphic-arts experience?



An inexpensive hand cutter for elementary graphic-arts projects

And to enumerate further, why cannot two or three hand cutters be provided in our junior-high-school shops as a safety means to keep small youngsters from crowding the large paper cutter? The cost is negligible and they are sufficient for elementary projects and handicraft work.

Bookbinding

Bookbinding is another large division of the graphic arts. This equipment for use in industrial-arts classes can be purchased for less than $50 and a unit of simple tools for 8 boys can be installed for about $125. Enrichment in the graphic arts is possible and at no great cost. Instructional materials are much cheaper than the replacement needed in typesetting and press feeding.

In several of the junior-high-school shops visited recently, it was found that the boys were standing upon makeshift boxes in order to reach the type case. Why can't type stands and cabinets be provided to meet the needs of these youngsters? How can we preach safety in industry when the shops are full of unnecessary potential hazards? If administrators continue to schedule graphic-arts classes in the seventh grade, suitable equipment must be provided and new courses of study offered.

The present equipment for printing as outlined in the INDUSTRIAL ARTS AND VOCATIONAL EDUCATION MAGAZINE[5] is essentially for typesetting, bindery, and press feeding. It must be supplemented and brought up to date if we are to provide for greater diversified activity and safety in the graphic arts.

Instructional materials are governed by the equipment, and since this is obvious, the problem is one of research that will prepare and provide more suitable equipment for a national program of graphic arts for our secondary schools. If this is not accomplished, instructors will have no choice but to teach equipment instead of meeting the needs and safety of the individuals in our graphic-arts classes. So again, what of graphic-arts equipment?

Summary

A graphic-arts laboratory equipped to provide sufficient activity for large groups must have more pieces of equipment. Machinery suitable to the needs of the pupils will cost considerably less than present equipment. The average shop cost in the secondary schools today is about $4,000. This is several hundred dollars too much. Boards of education can save money if a program is planned ahead of the purchasing of equipment. Therefore, it is expedient to analyze needs before money is expended.

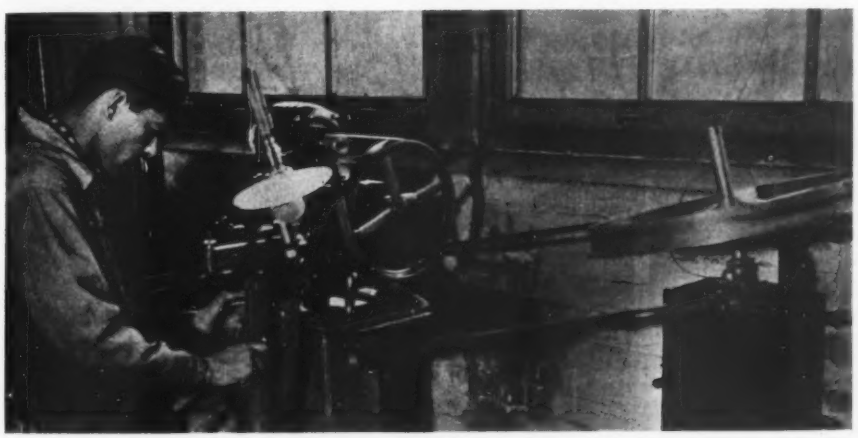
Equal educational opportunity can be provided only when each boy is given means to realize his problems and projects. If large classes continue, equipment must be provided which will make it possible for each individual to have access to tools and machinery long enough to learn how to use them. He must not be forced to be merely a group observer. More small proof presses and hand presses must be provided, to say nothing of other units for other phases of the great industry.

Industrial-arts printing, which means more than just a phase of relief printing, means providing for a greater diversified program. It means giving the boy problems in papermaking, bookbinding, block cutting, silk screening, photography, lithography, and engraving. Units of each can be procured reasonably just as soon as supervisors and administrators come to realize the limitations of the present program.

In a recent survey among junior-high-school shops in which there were student honor clubs, it was found that the following items were asked for as phases of the graphic arts they would like to see added to their plant: Bookbinding, more modern type faces, papermaking unit (pulp beater), silk screening, stereotyping-casting box, hand punch, lithographing unit (multilith), and photographic equipment. One of the requests of a great majority of the reports was for better lighting facilities — greater candlepower and indirect illumination. It was encouraging to know that so many instructors are conscious of a need for a greater variety of related-subject-matter equipment. Most of the items mentioned are in the low-cost field.

Present trends then, seem to indicate a need for a national program which will provide a basis for a working philosophy. Without this, instructors will continue to use the equipment and teach the trade program provided. The boys of our shops, the natural resources which we should develop and protect, will continue to get a misconception of the great graphic-arts industry and a sour outlook on the industrial world about them. What of our present graphic-arts equipment? Is it adequate in the light of present-day pupil needs and enrichment?

[5] "Printshop Equipment and Supplies," March, 1937, p. 39a; March, 1938, p. 49a.



This Foley saw filer has been installed at the Stout Institute, Menomonie, Wis. On it, unskilled but adequately instructed and supervised students keep the saws used in the woodworking department in as good or better condition than they would be kept by an experienced saw fitter working without a machine. H. M. Hansen, instructor

Budgeting the Drafting Room

H. D. Campbell

Morton High School and Junior College, Cicero, Illinois

A troublesome problem studied and discussed.

Preparing a budget for the mechanical-drawing division of an industrial-education department should be a pleasure since drawing makes the least demands upon the departmental income. Writing an article on this subject, however, is quite the contrary because of the great diversity of methods used in handling tools and supplies.

Woodwork and drawing were two of the earliest manual-training subjects and the budgetary peculiarities of the latter may be traced back to the dim past. Woodwork students were provided with workbenches, hand and machine tools; and supplies such as nails, glue, and sandpaper. All supplies were purchased by the department, stored in the shop, and furnished to the student free of charge when used in *exercise* making. Only when students made projects to take home were they asked to pay for the material. The money derived from the sale of materials was handled by the woodshop teacher. Shop students were rarely, if ever, asked to buy a textbook.

Equipment

Drawing students, on the other hand, were furnished with tables, stools, boards, blueprinting equipment, and certain tools used in common, such as large T squares, triangles, and irregular curves. Everything else was furnished by the students. Drawing, tracing, and blueprint papers were purchased by the department, stored in the room, and sold by the teacher. Drawing sets, tools, supplies, and textbooks were purchased at local stores or ordered through the school. Not infrequently, the school discount became the teacher's personal profit. Budgeting the drawing room was, in those days, remarkable for its simplicity.

Today the methods of handling shop finances are, generally speaking, the same as they were in the past. Drawing-room methods range all the way from that just described, to a position of approximate parity with the shops — speaking in terms of expense to the students.

While I do not know of any school which furnishes drawing sets and tools free to the students, there are an increasing number which furnish them at a moderate rental, thus making it possible for many of the students now attending high school to take drawing who would otherwise be unable to do so. Similarly, school stores, purchasing in large quantities and giving the students a major part of the school discount, make the cost of supplies somewhat less than in the past. Finally, free textbooks or lesson sheets furnished by the school have further lessened the burden.

Reducing the expense to the drawing student in the ways mentioned previously has complicated the problem of the industrial-arts budget. Part of it remains as it was, but the school store and the library have now entered the picture. The former presents, as far as the department is concerned, an almost unsolvable problem, for who can say how many drawing pencils, erasers, or bottles of India ink must be ordered for the drawing room when science and art students also purchase supplies there?

In investigating the drawing-room budget problem, I questioned teachers in ten schools selected to give representation to large, medium, and small enrollments; to the city of Chicago, the suburbs, and the country; and to schools where drawing was taught with vocational and cultural ends in view.

Per-Capita Costs

Per-capita costs to eight schools ranged between 89 cents and $1.06 per year, with an average of 98 cents, but this figure is quite valueless as identical components were not used by all.

Each of these schools included the cost of drawing paper to be sold to the students. The amount of drawing paper purchased ranged from 40 cents per capita to 58 cents, with an average of 50 cents. Due to the mark up which insured the schools against loss on these paper orders, the students paid about 10 per cent more than the schools.

Per-capita cost of tracing paper ranged from 4 cents to 12 cents per year, with an average of 8 cents. Whether or not this paper was sold to the students is not known.

Per-capita cost of blueprint paper ranged from 4 cents to 15 cents, average 9 cents. These figures are, of course, valueless, since, while a little of this expense can rightly be charged to drawing instruction, the bulk of it should be charged to the shops that order prints.

Only four schools listed purchases of drawing boards in their 1937–38 budget, although all furnish boards as a regular part of their equipment. Cost of boards ranged from 57 to 80 cents, and one correspondent said he expected boards to last five years.

Drawing Instruments

Three schools purchased sets for rental. One school paid $126.40 for 20 sets, another spent $399.30 for 50 sets, and a third listed $30 spent for an unspecified number of sets.

The first school mentioned, listed the sum of $39.04 spent for replacement parts and repairs on rental sets, while the third school included a similar cost of $6.

Per-capita cost of blueprint-machine repairs and supplies ranged from 3 to 10 cents with an average of 4½ cents. Again, this figure is of no value to other schools as it relates to the purely local shop demand for prints.

Per-capita costs of nine schools for lesson sheets, references, and magazines ranged between 10 and 12 cents, average 11 cents. The remaining school listed equipment and books together, hence the figure for the latter cannot be determined.

Let us return to the two schools which do not figure in the total per-capita cost given previously for eight schools.

One school gave the total expense for a drawing division with 116 students as $116.25. The items listed were tracing paper and cloth, blueprint paper, and chemicals, books, magazines, and a small sum for a considerable number of miscellaneous items. All drawing paper, pencils, pens, ink, erasers, triangles, T squares, drawing sets (averaging $3), textbooks, etc., were handled through the school store and charged to the general, not the drawing-room, budget. Had this school budgeted the draftsmen as the other schools did, the per-capita cost would have been between $1.80 and $2. The 1937–38 cost to this school's store for articles sold to drawing students was $379.95 and the cost to students was $417.95 or a mark up of 10 per cent.

The remaining school listed an expenditure of $399.30 for drawing sets, which made a total sum of $607.27 for the year. A further complication is the fact that this school had 110 students who were taking drawing daily and 200 who alternated between shop and drawing. The rental sets were purchased by the school store and the expense was charged to the school as a whole — not to the drawing room. In this school, books and magazines are purchased by the school library. T squares, triangles, and scales are also owned and rented by the school store. The only items which appear in this drawing-room budget are drawing, sketching, tracing, and blueprint paper, ink, Scotch tape, blueprint-machine supplies and repairs, and a small miscellaneous item. The total is $207.97. If this is divided by 210 (the average number of drawing students at any given time), the per-capita cost is again very nearly $1 per year. As said before, however, despite the fact that all ten schools average approximately the same, the figure is valueless since there is no agreement as to what items to include in the budget.

Popularity of Renting Sets

Despite the generally unsatisfactory results of this study, as they relate to the budget, many things of interest to drafting teachers were unearthed — a few of which follow.

Where it is possible to rent sets, a majority of industrial-art and vocational students alike prefer to do so. Most of those who furnish their own have old sets handed down to them by fathers, brothers, or uncles, while most of the remainder today buy sets which cost from $3 to $4. A drawing-supply-house salesman who has been in the business 25 years told me that small-town school boys bought sets costing about $1 more, on the average, than did city boys.

Vocational students usually rent sets until their last year or semester, and then buy sets costing from $10 to $15. Now that pencil tracings have quite largely taken the place of ink tracings in industry, the beam compass set is favored over the older type.

Sets purchased by the school to be rented cost from $6 to $8 since the more expensive sets are more likely to possess longer life. The school in which I teach bought 200 sets at $6 each in the fall of 1920. Today, 86 of these sets are still earning 25 cents rent a semester, and have long ago paid for their cost and upkeep. Each renter takes a card home to be signed by his parent who thereby agrees to pay for the loss of or damage to the set rented by his son, and in this way the school is protected against financial loss. These sets become, for all practical purposes, the boy's property for the semester. Two other schools use this method.

Two of the schools questioned own sets which remain at the drawing table and are used in common by all classes. Students pay a fee for their use which pays for the sets in time.

One school rents T squares, triangles, and scales and sets for 50 cents a semester. Another school charges a fee for the use of set and tools. A $1 deposit is required for a year's use. If there is no damage to them, 50 cents is refunded at the end of the year.

Supplies Handled by School Store

Paper, pencils, ink, and similar supplies are still sometimes sold by instructors in the drawing room, but the growing practice is to turn this bothersome interruption of teaching time over to the school store. Where large enough quantities can be ordered at one time, very reasonable prices can be charged students. The following 1937–38 prices are typical: H to 6H pencils, 7 cents; erasers, 4 cents; art gum, 5 cents; 24-in. T squares, 25 cents; 6-in. 45-deg. triangles, 15 cents; 8-in. 30-deg. triangles, 15 cents; triangular scales, 30 cents; India ink, 20 cents.

One school store buys India ink by the quart at $3.40 and fills 40 of the ¾-oz. bottles. Students furnishing their own bottles may get a refill for 10 cents.

Most schools in which teachers handle paper or other supplies sell students' tickets, with numbers or spaces around the edges, for from 5 to 25 cents. Teachers punch these numbers or tear off the marked spaces as the ticket is used up, thus avoiding the handling of money with its inevitable day of reckoning.

Up until this time, we have been considering the budgeting of drawing from the school's point of view. Let us consider it from that of the student.

We have seen that a student who buys his own set will, on the average, pay between $3 and $4 for it. His T squares, triangles, and scale will cost between 85 cents and $1.70, with an average of $1.23. Pencils, erasers, ink, tacks or tape, and paper will cost from 80 cents to $1.40 a semester, with an average of $1.15. Thus, a student who furnishes his own drawing set, tools, and supplies for a year must spend from $5.50 to $8.50 if he has only the items listed previously. Of course, if he takes further work, the ultimate expense is less since he has his set and tools. Where drawing is given for cultural and guidance purposes, few spend enough time in drawing to justify — especially today — the investment of any considerable sum. With this in mind, the following suggestions are made as to the ideal organization and allocation of expenditures in drawing, although it will scarcely add to the ease of budgeting the drawing room.

1. The industrial-education department should furnish tables; stools; boards; equipment used in common as drafting machines, large T squares, triangles, curves, lettering guides, etc.; blueprinting equipment and supplies.
2. Drawing sets, T squares, triangles, and scales should be purchased by the school store and rented to students (for their personal use) for a sum which will protect the school against loss.
3. Supplies such as paper, pencils, erasers, etc., should be bought by the school store and sold to students as near cost as possible.
4. Free textbooks should be issued to drawing students the same as to academic students.
5. Reference books and magazines should be purchased by the library.

Budgeting the Auto-Mechanics Shop

H. M. Jellison

Director, Department of Vocational Education,
Akron, Ohio

Budgeting as it is applied to auto-mechanics courses in cosmopolitan and vocational schools at Akron, Ohio.

One of the most popular courses in an industrial-arts and vocational-education program is the auto-mechanics course. The elaborateness of the equipment depends very much upon the purpose for which the course is designed. The junior-high-school course may be set up with a minimum amount of equipment; the senior-high-school course would be quite comprehensive in its setup; and the vocational high school should have all the equipment necessary to prepare students for entrance into the trade.

In this article are listed the minimum equipment and supplies which are deemed necessary for the efficient operation of a vocational-high-school shop, in order that subtractions may be made from this outline to fit the needs of a junior- or a senior-high-school setup. It also contains a breakdown of the instructional units and a possible financing outline for the problems entailed in the shop setup.

One of the first problems confronting the administrators of industrial arts and vocational education is class size. In some school systems, per-capita cost seems to be the yardstick by which the efficiency of the shop program is measured. In the opinion of the writer, no teacher should be asked to handle more than 30 students in any one class. Twenty students should be all that any auto-mechanics shop instructor should be asked to handle in a shop to which the public is permitted to bring cars for repairs.

A properly organized auto-mechanics course should be divided into two separate and distinct divisions, a beginning division, and an advanced shop. The beginning division should work only on motors, transmissions, and rear axles which have been obtained from dealers and which are permanent equipment of the school. Instruction in this division should embrace both the mechanical and the theoretical. The mechanical portion of the course is to impart a thorough understanding of the mechanical operations and adjustments needed in the various types of equipment. The theoretical part of the work is to deal principally with the operation of the various units. Experiences obtained by the students in the beginning division will equip them to handle (under instruction)

the customers' cars which are brought into the advanced shop. Students should be required to spend at least one semester in the beginning division. The second important division is the garage proper where cars may be brought in for any repairwork from a minor mechanical job to a complete overhaul job.

The beginning and the advanced shops offer two financial problems. In the beginning shop, motors, transmissions, and rear axles are disassembled and assembled many times. The loss of parts is small. The bolts, nuts, cotter keys, and the like, cost very little. Therefore, a small yearly budget to take care of supplies and tools is all that is needed here. Engines, transmissions, and rear axles can be exchanged frequently at junkyards for more modern ones, at a very slight cost. As all of this equipment in the beginning shop is used in the school proper and none taken outside, the yearly budget for this shop can legally be appropriated from public-school funds.

The advanced shop, however, presents an entirely different situation. An adequately equipped toolroom is the first essential for this shop. If customer work is permitted to be taken care of in this shop, special tools and equipment are needed to do the numerous jobs required on the modern automobile. We must bear in mind that the old auto-mechanics shop of ten years ago is no longer suited in today's scheme of automotive-repair education. The modern car of today is so constructed that very little work need be done until the car has been driven many thousands of miles. Motor analyzing, tune-up, lubrication, brakes, tires, etc., form the basis of our present-day shop training. It is necessary, therefore, that a variety of type jobs be brought into this advanced shop in order that the student may obtain a well-rounded auto-mechanics training. Two or three partly wrecked cars should be brought into the shop each year for a complete overhaul.

To do the work just outlined, requires that the administrators of this type of activity set up some very definite policies for the operation of the shop. In the past many auto-mechanics instructors have been deluged with car owners wanting work done for nothing. This in itself has defeated many of the purposes for which the school or class was established. Cars taken into this shop are taken in for the type of repairwork involved. This type of repairwork should always fit the course of study set up for the complete education of the students. The customer should always be informed that the car must be left a sufficient length of time to do the repair job properly and to furnish the educational information to the students.

The problems of financing this type of shop are many. The budget should be set up from funds obtained from sources other than tax money. It is advisable that a small fund be set aside to take care of parts and supplies which will be used to repair special cars brought into the shop. It is important that this fund show no loss but rather a small profit. This can be done by agreements with the local automotive-supply dealers, from whom parts and supplies may be bought at a discount and for which list prices are charged to the customer. Labor at all times is free.

Equipment and tools which are not consumable and which form a permanent part of the shop should be bought with funds from the regular tax budget. A consumable material account should be kept by the shop teacher, school principal or clerk and should be set up in such a way that the books will show all items of receipts and expenditures and to do this it will be required to have job tickets for each job. On account of the legal provisions in most school laws, all material should be purchased by a purchase order bearing the name of the school and the department. Petty cash paid out should always be accompanied by a receipt. Books should be subject to audit at all times by the clerk-treasurer of the local board of education and the state auditor. In order that the losses and bad accounts may be reduced to a minimum, it must be a fixed policy that no car be removed from the shop until the bill is paid in full.

The method of starting this consumable supply-and-equipment budget is very simple. A small amount of money may be loaned to this department which will be paid back as soon as possible. After this money has been paid back, the shop should be very definitely on its own, insofar as the purchase of consumable materials is concerned. Over a period of years this budget may become large enough that certain amounts may be used for the purchase of special tools and equipment. This should not, however, be the ultimate aim of the budget. The obligations and objectives that maintain the efficiency of this shop are just as important as those of any other shop in the school system.

The complete auto-mechanics-shop plan for the Hower Vocational High School in Akron, Ohio, represents an expenditure of approximately $15,000; $10,000 for equipment and $5,000 for tools. Ten years of operating the shop itself have been responsible for the purchase of approximately $2,500 worth of tools and supplies. Some of the equipment such as cylinder reboring machines, motor reamers, electric- and acetylene-welding outfits, motor analyzer, etc., are not shown on the chart. The shop is modern in every respect and the toolroom contains many special tools. Using the layout of this shop as an example, provisions have been made to set up smaller auto-mechanics shops in our senior high schools. The cost of each of these units is approximately $2,500. This amount covers both equipment and supplies. These high-school shops, require about one half the floor space occupied by the Hower shop, and the course taught is more of the lecture and demonstration type. The methods of financing work done on the customers' cars is the same as that used at the vocational high school.

Many auto-mechanics schools have set up special auto electric departments. At the Hower Vocational High School, auto electricity is taught as a part of the first year's course. It is continued in the advanced auto-mechanics shop by the instructor only as the problems arise on jobs brought in from the outside.

Electricity in the General Shop

E. W. Jones

Kansas State Teachers College, Pittsburg, Kansas

A budget survey to determine the installation and annual equipment and supply needs of electricity in the general shop.

Electricity is a popular unit in the general shop, and rightly so, but where such shops are new, or have not yet been started, the questions of cost, shop space, and the necessary equipment and supplies arise in the minds of teachers and administrators. In an attempt to find a partial answer to the problem, a survey was made by the questionnaire method among 120 schools scattered throughout the western half of the United States.

The items asked for were the number of weeks electricity is offered, also the bench and floor space used, and the cost of tools, equipment, and supplies, with lists of same. A sketch of the shop plan was requested, showing the arrangement of the various working areas, location of equipment, and other features. Returns were received from nearly three fourths of the 120 schools. Some answered that they did not offer electricity. Admittedly a survey covering the whole country would be more exhaustive, but it is believed that the results would not greatly differ from those that were obtained.

The greater number of schools reporting classify electricity as a general shop subject. Others classify it as a unit shop.

TABLE I. BUDGET FOR THE GENERAL SHOP

	Per Student		Per Shop	
	Aver.	Range	Aver.	Range
Number of weeks electrical course is offered, 70 per cent of schools			6	4-9
Number of weeks electrical course is offered, 30 per cent of schools			18	12-36
Number of students taking electricity at one time			10	5-25
Number of students taking electricity per year			60	20-100
Length of bench space (feet) used in electrical shop	2.5	2-4	25	6-48
Area of floor space (square feet) devoted to electricity	20	10-40	576	40-1000
Cost, new, of permanent equipment	$3.00	$2.50-$5.00	$38	$30-$200
Cost, new, of tools partly or wholly used in electricity	$1.42	$0.60-$4.00	$43.	$15-$100
Cost, yearly, of new tools & equipment to maintain shop adequately	$0.80	$0.25-$2.00	$24	$5-$50
Cost, new, of consumable materials & supplies to start shop	$1.17	$0.50-$2.00	$34	$12-$100
Cost, yearly, of consumable materials & supplies to operate shop	$0.66	$0.40-$1.00	$31	$15-$100

Both large and small schools are found in both classes. Earlier established shops and those in large cities are predominately unit shops, while those started recently, and especially in the smaller schools, are usually general shops. There are exceptions in both cases, however, which accounts for the wide range of results appearing in the tables. It will be noted that the data are tabulated under two headings, *per student* and *per shop*. The *average* and the *range* between upper and lower limits are given for each heading.

Table I, shows the budget for the general shop, for which the survey was primarily conducted. Figures for the unit shop in the second table are given for comparison only. It appears that the cost per student is lower in the unit shop. This may be explained partly by the larger number of students handled in unit shops and partly by the greater portion of time devoted to demonstration and recitation, and less to shopwork, a practice not usual in general shops.

Figure 1 pictures a floor plan of a general shop showing locations of working areas devoted to the various activities and arrangement of principal machines and equipment. Chairs are placed around the *planning center*. This plan was submitted by Milton W. Schrag, Augusta, Kans.

Tools and Equipment

The survey did not reveal much uniformity in the way of tools and shop equipment used in electricity. Financial support, length of course, the number and type of projects constructed, and the other kinds of work requiring similar equipment carried on at the same time are governing factors which vary widely. However, there were certain items listed by most of the schools reporting that may be considered essential in a well-equipped shop. These are given in List No. I. List No. II is determined more by the kind of projects made in electrical shop, and is, therefore, less complete.

Several of the items appearing in these lists, are also used in other units of the general shop, and, in turn, a number of items required in other units may be employed in electricity. This suggests adjoining locations for certain areas in the shop, as indicated on the floor plan shown in Figure 1, where electricity is placed near both the woods and the metals.

TABLE II. BUDGET FOR THE UNIT SHOP

	Per Student		Per Shop	
	Aver.	Range	Aver.	Range
Number of weeks electrical course is offered			21	9-36
Number of students taking electricity at one time			54	20-160
Number of students taking electricity in one year			106	30-330
Length of bench space (feet) used in electrical shop	4	1-8	60	20-200
Area of floor space (square feet) used in electrical shop	15	10-25	1100	750-2000
Cost, new, of permanent equipment	$2.75	$2.40-$5.00	$295.00	$125-$800
Cost, new, of tools used partly or wholly in electricity	$1.38	$0.62-$1.80	$147.00	$25-$600
Cost, yearly, for new tools & equipment to maintain shop adequately	$0.42	$0.25-$1.00	$45.00	$20-$100
Cost, new, of consumable materials & supplies to start shop	$0.50	$0.20-$0.90	$47.50	$15-$200
Cost, yearly, of consumable materials & supplies to operate shop	$0.50	$0.20-$0.90	$53.50	$15-$200

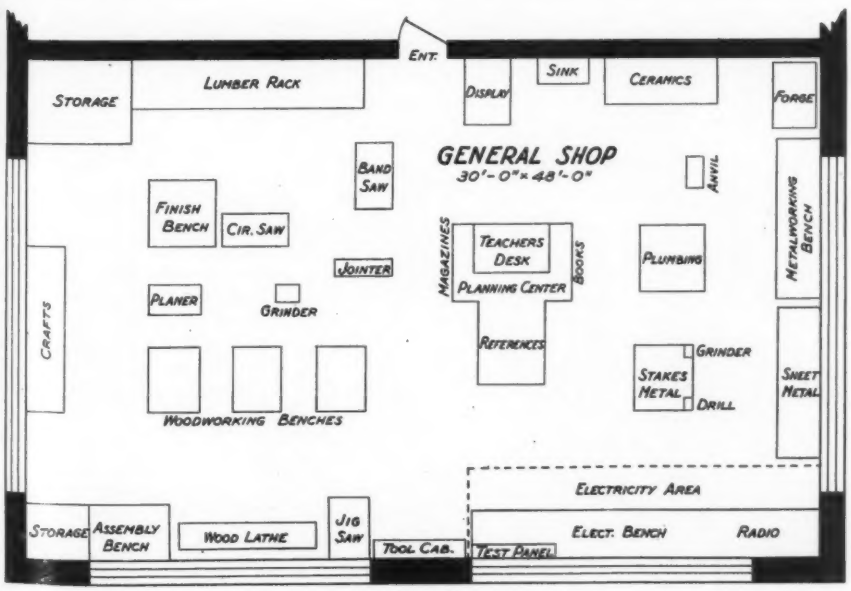


Fig. 1. Floor plan for general shop

List I. Tools and Equipment

Ammeters, a.c., 5- and 30-ampere scales. At least one of each.
Benches with machinist's vises, 2- to 3-in. jaws. Storage under benches.
Braces, ratchet, for square or round shank drills.
Bulletin board.
Chisels, cold and wood.
Compass, magnetic, small.
Dies and taps, machine-screw sizes.
Drill press, pedestal or bench type.
Drills, hand, with set of wire gauge drills, 1 doz. each of sizes No. 45, 36, 28, 25, 18, 10, also ¼ in.
Drills, square shank, sizes ¼, 5/16, ⅜, 7/16, ½, and ⅝ in.
First-aid kit.
Files, flat, round, and 3-cornered.
Grinder, pedestal or bench type.
Hack-saw frames, with half gross of blades.
Hammers, ball peen and claw.
Magnets, permanent and electric.
Pliers, side cutting and gas.
Punches, center and pin.
Screw drivers, small, medium, and large blades.
Soldering coppers, 1 and 2 lb. per pair.
Soldering furnace.
Storage battery, with charger and hydrometer.
Tinner's snips, 3 in.
Tool cabinet, may be made.
Transformer, general purpose, may be made.
Try squares, 8-in., steel bodies.
Voltmeters, a.c., 15- and 150-volt scales.
Wrenches, adjustable.

List II. Tools and Equipment

Baking oven, for coils.
Coil winders, hand made.
Dividers.
Foot-candle meter.
Lockers.
Mallets, leather faced.
Nippers, end, 8 in.
Scales, small spring.
Scissors.
Scratch awls.
Small motors, old.
Speed indicator.
Squaring shears.
Steel rules.
Test lamp.
Transformers, 6-volt.
Torch, gasoline.
Varnish brushes.
Wire gauge, B. & S.
Wood bits, ¼ to 1 in.
Wood bit, expansive.

Materials and Supplies

The lists of materials and supplies furnished by the schools reporting varied even more than those of tools and equipment. This is to be expected, since they are governed to a greater extent by the kind and number of projects employed. But, in a similar manner, a number of items were listed by nearly all schools, making them appear to be the more important. These are given in List III.

List IV carries items occurring less frequently, but which appeared at least several times. Such items are used only where special projects are constructed, and these vary greatly from school to school. Obviously, a master list to fit all requirements would be excessively long and difficult to obtain. Quantities to buy are entirely controlled by the size of classes. They are not suggested here, except minimum quantities for a few items.

List III. Materials and Supplies

Bells, 2½ in. gong.
Buzzers, a.c., may be made.
Cord, all-rubber, parallel, No. 18.
Cord, heater, asbestos insulated, No. 16.
Cord, type C, cotton covered, No. 18.
Dry cells, 6 in. and flashlight cells.
Fuses, plug and cartridge.
Glue, liquid.
Insulated staples, ½ in. long.
Nails and brads, various sizes.
Plugs, attachment and appliance.
Push buttons.
Screws, machine, roundhead, brass or iron, 1 gross each of following sizes: Size 6–32, ¼ and ⅜ in. long, with 2 gro. hex nuts; size 8–32, ½, ¾, and 1 in. long, with 2 gro. hex nuts; size 10–24, 1 and 1½ in. long, with 2 gro. hex nuts; size 14–20, 1½ and 2 in. long, with 2 gro. hex nuts.
Screws, wood, f.h. bright, r.h. blued, r.h. brass, various sizes.
Sockets, key, pull chain, receptacles No. 50715C.
Solder, bar, wire, rosin core.
Soldering paste.
Stove bolts, sizes ⅛, 3/16, and ¼ in. in various lengths, with nuts. (A cheap substitute for machine screws.)
Tape, friction, rubber.
Wire, bell or annunciator, No. 20.
Wire, magnet, Nos. 30 and 26, enameled.
Wire, magnet, Nos. 22, 20, and 16, cotton enameled.

List IV. Materials and Supplies

Brass tubing, ¼ and ⅜ in. I.D., 1/16 in. wall.
Copper rod, ½ in. diameter.
Fiber, vulcanized, 42 by 48 in. sheet, 1/16 in. thick.
Fiber tubing, vulcanized, ½ and ⅝ in. I.D., 1/16 in. wall.
Lamps, incandescent, various sizes.
Micanite tubing, ½ in. I.D., 1/16 in. wall.
Nichrome wire, bare, Nos. 30 and 22.
Paper, asbestos, 1/32 in. thick.
Paper, insulating, .010 in. thick.
Parts of automobile ignition system.
Radio tubes and parts.
Renewal elements for irons and toasters.
Sheet copper, brass, and aluminum.
Sheet iron, black, old transformer laminations.
Shingles, asbestos, or transite, ⅛ in. thick.
Sleeving, cotton No. 0, and asbestos, ⅛ in. 1 lb. of each.
Steel tubes (thin-wall conduit) ½ and ¾ in. sizes.
Switches, snap, toggle, knife.
Tape, cotton, 1 gross yards, ¾ in wide.
Tin, bright charcoal, heavy.
Varnish, air drying, black.
Varnished cloth insulation, .007 in. thick.
Varnished tubing, 1/16 in. and ⅛ in. sizes.

School Shops

Chicago Industrial-Arts Laboratory Plan

Louis V. Newkirk

Director, Bureau Handwork and Industrial-Arts Education, Chicago, Illinois

A short article on the Chicago Industrial-Arts Laboratory appeared in the March, 1937, issue of this magazine. At that time the course had been outlined and was being used experimentally in five Chicago high schools. Approximately 500 boys were enrolled in the course and much of the supplementary material was still under preparation. Due largely to the leadership of Dr. William H. Johnson, superintendent of the Chicago schools, and Mr. George F. Cassell, assistant superintendent in charge of Chicago high schools, and the fine co-operation of teachers and principals, the industrial-arts laboratory has developed rapidly during the past two years until we now have 75 laboratories and over 8,000 ninth-grade boys taking the work. The majority of these new laboratories are new shops added to the schools, and 25 are shops that have been converted into industrial-arts laboratories.

Fig. 1. Booth at 1938 Illinois Vocational Association convention

A detailed exposition of this new development.

While the Chicago industrial-arts laboratory plan is and will continue to be modified from time to time as better methods and new instructional content are introduced into the work, there are a number of characteristics which have become rather clearly defined. It is my purpose in this article to describe some of the major characteristics of the Chicago industrial-arts laboratory plan including the objectives, administrative procedure, content, methods, shop plan, equipment, and qualifications of the teachers.

The Chicago industrial-arts laboratory is offered to ninth-grade boys in the general or academic high schools. The classes meet five double periods each week with five additional periods of drawing. The work is required of those who are planning to take a technical course, and is elective to all other ninth-grade boys. The work at present is adjusted to the accomplishment level of boys who have not had any departmental industrial arts in grades seven and eight. The level of difficulty of the instruction will be adjusted to fit the needs of those who will have had the new course in home mechanics now being introduced for boys and girls in grades six, seven, and eight. The standard class size is from 25 to 30 boys. The girls in the

ninth grade take a course in home arts, so do not ordinarily elect a course in the industrial-arts laboratory.

The Chicago industrial-arts laboratory is a shop course. Over 80 per cent of the pupil's time is spent in active work with tools and materials and the remainder in related educational procedures. The boys are taught the correct methods to use hand tools and small machines. However, the industrial-arts laboratory is not a vocational course, and ninth-grade boys are not expected to achieve the speed and accuracy that is demanded of older boys in advanced vocational courses.

The industrial-arts laboratory is motivated by the purpose of general education. It is given only in general educational high schools and their branches. The Chicago plan is intended to provide exploratory experience in the field of modern industry and to make a contribution along with all school and social agencies to the cultural, social, and vocational growth needs of ninth-grade boys.

Objectives of the Course

The guiding philosophy of the Chicago industrial-arts laboratory is as follows:

Interpret the modern industrial and trade world to boys in the academic high schools. Today industry is so extensive and varied that boys need an opportunity to study the many types of industries and to learn what vocational possibilities can be reasonably expected if they decide to enter the industrial field. This objective is particularly important in Chicago because of the number and varied types of industries that are available.

Provide handwork experiences with a variety of tools and construction materials typical of modern trade and industrial life. The industrial-arts laboratory provides an opportunity for the boy to work with the common construction materials, such as metal, wood, paper, glass, plastics, textiles, leather, and clay. These materials are worked with hand tools and small machines. They are used in a variety of projects and experiments to develop elementary skill and to objectify and illustrate important industrial processes.

Provide opportunities for developing desirable personality and social traits. The industrial-arts laboratory offers unusual opportunities for developing desirable social traits. The pupil may work as an individual, as a member of a small group, or as a member of the large group. He has opportunities to develop leadership and to work as one of the group.

They provide craft experiences for leisure-time interests and promote the development of the home workshop. The industrial-arts laboratory acquaints boys with a variety of craft activities and often provides the basis for hobbies that can be further developed out of school hours in the home workshop. The industrial-arts laboratory teacher makes a special effort to promote the development of the home workshop for the boy with mechanical ability and interest in developing the crafts.

Content of the Course

The industrial-arts laboratory course is divided into eight large instructional areas as follows: Planning, metalwork, transportation, housing, ceramics, textiles, graphic arts, and electricity. Each one of these instructional areas encompasses a large section of the trade and industrial world. For example, the graphic arts includes printing, bookbinding, papermaking, and illustrating; ceramics includes brickwork, glass, cement, and pottery; transportation includes aeronautics, waterways, railways, and automotives; planning includes sketching, drafting, blueprinting, designing, engineering, tracing, and checking; housing includes mason work, carpentering, cabinetmaking, plumbing, heating, plastering, and decorating; metalwork includes machine-shop practice, molding, pattern making, and work with structural steel; textiles includes preparation, spinning, weaving, and dyeing; and electricity includes power and communication.

These eight instructional areas were selected after an extensive study by a committee composed of high-school principals and industrial-arts teachers. The classification of the trades and industries into

Fig. 2

Fig. 3. Headwork and handwork

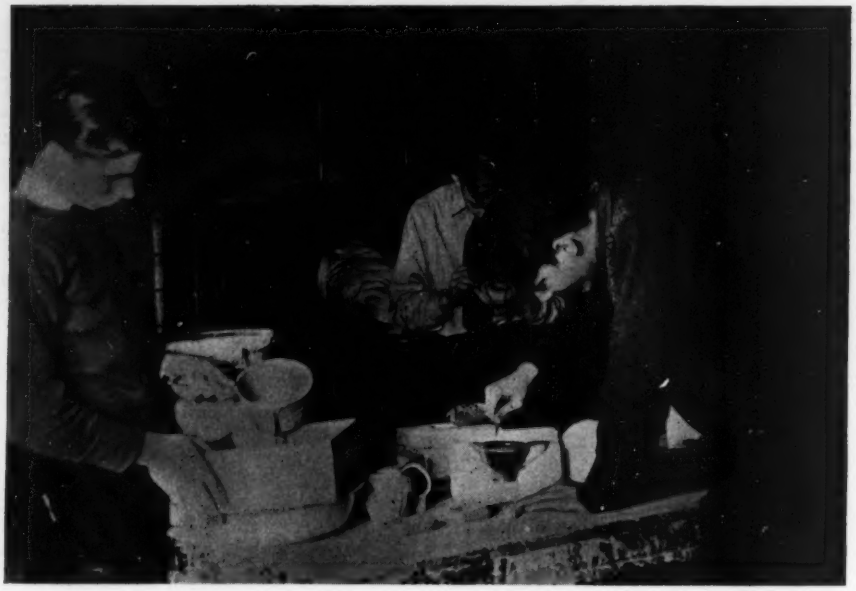


Fig. 4. Ceramics is popular with the boys

related groups helps in giving an organized overview to the boys and simplifies the problem of organizing the equipment and instructional materials.

Each of the instructional areas of the industrial-arts laboratory has been analyzed into the various phases of the industry or trade fields represented. A graphic analysis was prepared for each instructional area which shows important historical developments and a cross section of the area as it is today. These graphic-analysis charts are used as one of the teaching devices in the course to help in giving the boy a related picture of each area.

Methods

The industrial-arts laboratory teacher is not limited to a purely manipulative approach. He does not use one technique, but all the methods that are available. The more common methods used in our industrial-arts laboratories are construction work, individual and small group work, teacher and pupil demonstration, related references, moving pictures and slides, bulletin board, charts, tests, and trips to related industries.

The Chicago industrial-arts laboratory texts are designed to give the teacher and pupils a wide selection of possible activities in each instructional area. Each text is divided into the following divisions: introduction which gives a brief history and description of the studies or industries that are involved in the unit; a vocabulary division which properly defines the new technical words that are used in the unit; a list of suggested projects for the pupils; equipment that relates to the industrial processes that are involved in the unit; information units on tools and materials; trips to points of related interest; related visual-education materials; and a bibliography for teacher and pupil reference. The industrial-arts laboratory textbook series is tentative in form, flexible in content, and will be continuously revised in the light of experience in the Chicago industrial-arts laboratory. In addition to the Chicago texts each industrial-arts laboratory is equipped with a reference library, and teachers are encouraged to make contributions of their own.

Motion pictures of trade and industrial practice and trips to industry are of value in acquainting the boys with present-day industrial and trade practice. The motion picture is used more frequently than the trips, but one trip a semester is considered a minimum.

Individual and group projects are used in each of the eight areas of the industrial-arts laboratory, but projects do not completely meet the needs of the teacher and pupils. Projects are frequently supplemented by brief experiments which show important industrial processes or which illustrate significant information. For example, in the housing units, experiments with different types of insulating materials are valuable in giving the boy a better idea of good building construction. In the ceramics units concrete slabs made with different mixes are tested for strength, and in the study of textiles, fabrics are tested to determine quality.

The industrial-arts laboratory also correlates with other ninth-year subjects. It contains a wealth of objective material that may be used as topics for written and oral expression. The content of the laboratory course gives a natural motivation for reading in the fields of science and industry, and is correlated with the home by stimulating an interest in crafts for leisure.

Shop Plan

The most common room arrangements for the industrial-arts laboratory are the one-room and two-room types. The one-room arrangement is less desirable because it may not provide adequate physical facilities and teaching staff to present a complete industrial-arts laboratory course. The one-room type is used only in a small branch school where the teaching staff, number of pupils, and room space are limited. The one-room one-teacher laboratory usually presents four or five of the eight units of the industrial-arts laboratory course. It is, however, much better for purposes of general education for ninth-grade boys than a shop which presents only one area. For example, a one-room industrial-arts laboratory may present electricity, graphic arts, housing, and metal and give the pupil an introduction to a large part of our trade and industrial world, while a room equipped for only one type of activity is much more limited.

Fig. 5. His first metal coating

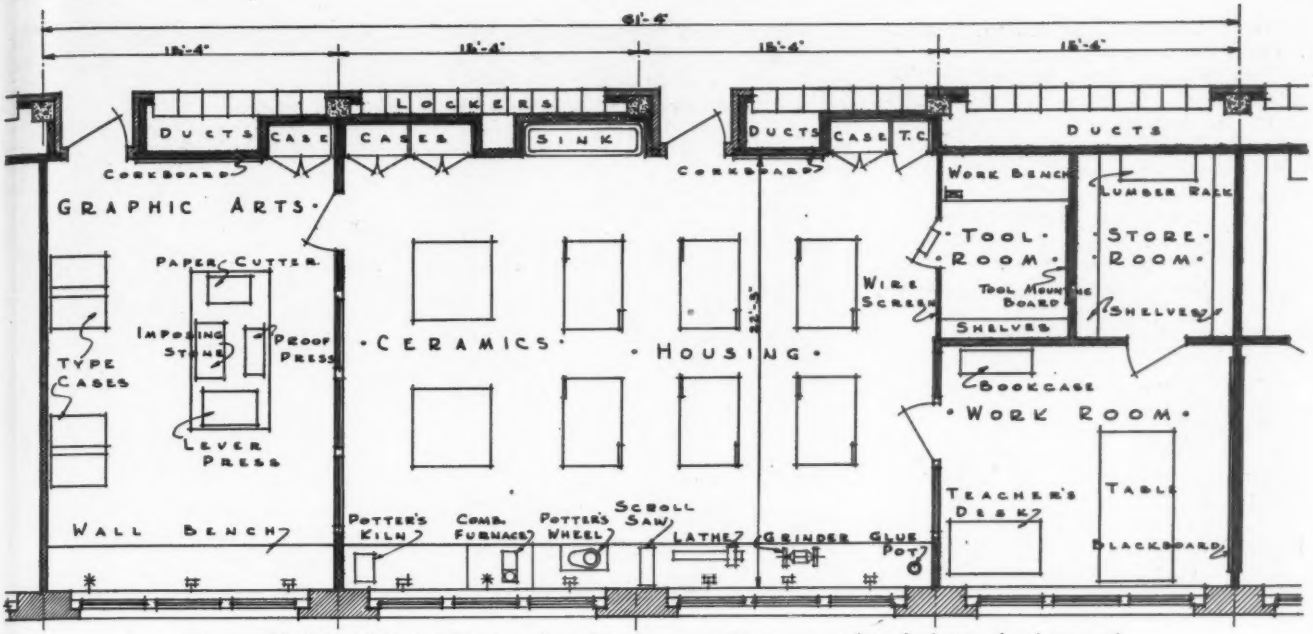


Fig. 7. This industrial-arts laboratory floor plan is arranged to accommodate the instructional areas of graphic arts, ceramics, and housing

Figures 7 and 8 show floor plans of the standard two-room industrial-arts laboratory. The two-room laboratory has proved to be an excellent type; however, the one-room laboratory is frequently used in branch high schools where the enrollment does not justify the two-room and two-teacher setup. Although a standardized plan is available for both the one-room and two-room types they are frequently varied in the light of school facilities and community needs.

Shop Arrangement

The arrangement of an industrial-arts laboratory room is a problem requiring good judgment and ingenuity. A first-floor room about 25 feet wide and 60 feet long is desirable.

The room should be arranged to provide space for a toolroom, supply room, and student workroom. Usually these facilities can be provided at one end of the room which will leave the major part of the floor and wall space for class instruction. A small workroom is valuable for the student when he wishes to do some reading or planning preparatory to the actual manipulative or experimental work in the laboratory. A supply room and toolroom are essential in keeping the variety of tools and materials accessible and in good order.

The central portion of the industrial-arts laboratory room really determines the type of instruction offered and should be kept flexible so that it can be varied to meet changing or unusual conditions. It must afford space for installation of workbenches and simple machines, and give room for assembly in case of auto mechanics or group projects.

Ventilation, lighting, relation of instructional areas, safety, and sanitation are other factors of real importance in planning the industrial-arts laboratory. The matter of ventilation has always been a problem needing careful attention but it is especially important if the laboratory

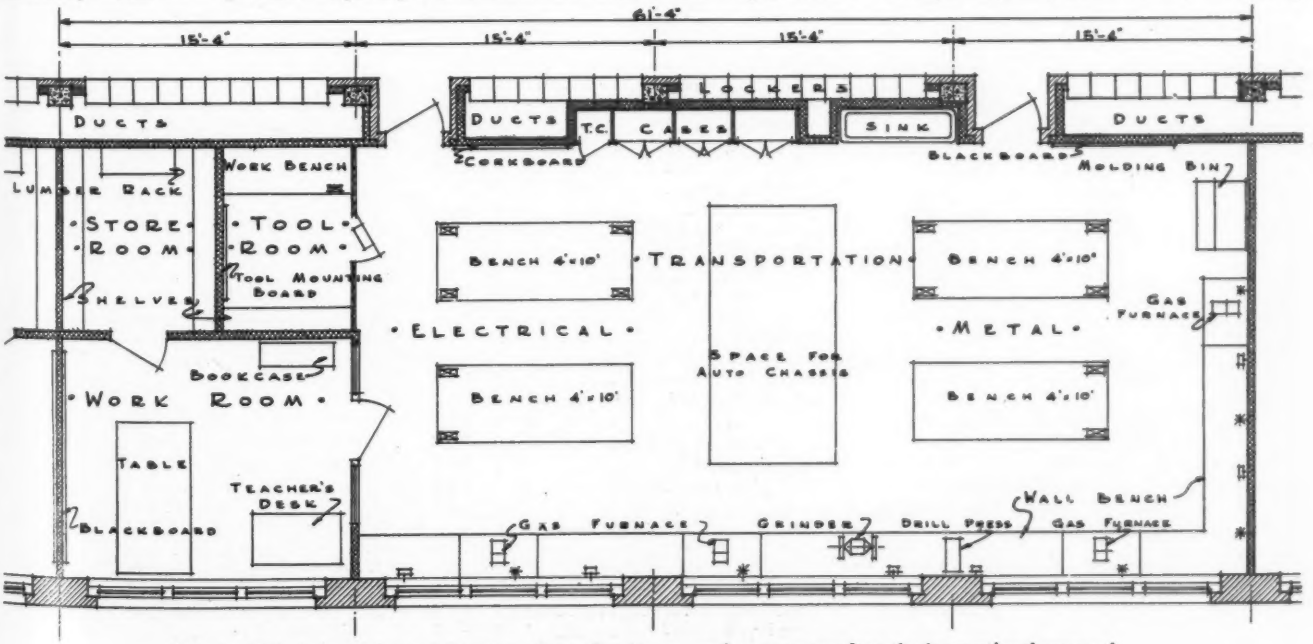


Fig. 8. This industrial-arts laboratory floor plan is arranged to accommodate the instructional areas of electricity, transportation, and metal

has a transportation division where automobile motors are run.

The instruction areas in the industrial-arts laboratory are grouped to facilitate instruction. For example, transportation, metal, and electrical will work together and provide various opportunities for helpful correlation.

The industrial-arts laboratory requires a variety of hand tools and construction materials but no large power machines. The fact that the work can be conducted without large power machines greatly reduces the cost of installation. A jig saw, electric kiln, potter's wheel, grinder, drill press, lathe, loom, small gas furnaces, and a small press constitute about all the power equipment that is desirable to teach all eight units of the industrial-arts laboratory course. A one-room laboratory with facilities for thirty pupils can be equipped for about $2,000 depending on the price levels at the time of the installation.

In the following tables are listed the tools and machines that are used in the instruction areas of the Chicago industrial-arts laboratories. These lists are modified from time to time but it is hoped that they will prove suggestive to any one who is considering industrial-arts laboratory work.

General (Minimum equipment)

	Number of Students			
Equipment	*5*	*10*	*15*	*30*
Blackboard	1	1	2	2
Bookcase	1	1	2	2
Bulletin boards	1	1	1	1
Cabinet, first-aid	1	1	1	1
Cabinet for class records	1	1	1	1
Can, oily waste	1	1	1	1
Desk, teacher's	1	1	1	1
Fire extinguisher	2	2	2	2

Planning (Minimum equipment)

	Number of Students			
Equipment	*5*	*10*	*15*	*30*
Blueprint frame	1	1	1	1
Blueprint-paper tube	1	1	1	1
Compasses, pencil	6	10	15	30
Curve, irregular, No. 21	1	2	4	6
Drawing boards	3	5	8	15
Drawing boards, large	2	3	4	6
Drawing boards, 18 by 24 in.	6	10	15	30
Pans (water for blueprints)	2	2	2	2
Paper cutter	1	1	1	1
Pens, lettering, assortment	1	1	1	1
Protractor	1	1	2	4
Rules, 12-in.	6	12	15	30
Shears	1	1	1	1
Tape, steel, 50 ft.	1	1	1	1
Triangles, 30–60-deg., 10 in.	6	10	15	30
Triangles, 45-deg., 8 in.	6	10	15	30
T squares	6	10	15	30

The planning or general drawing unit is taught in a separate room in Chicago, and the drawing that is done in the shop relates specifically to the instruction. Some schools in other cities include the planning unit in the same room.

Electricity (Minimum equipment)

	Number of Students			
Equipment	*5*	*10*	*15*	*30*
Batteries, dry cell	8	8	10	12
Benches	2	4	6	8

Fig. 6. Graphic arts is a big industry in Chicago

Buzzers	6	8	10	12
Center punch	2	4	6	8
Chisel, cold, ⅜ in.	1	2	3	3
Chisel, cold, ½ in.	1	2	3	3
Combination square	1	1	2	2
Dividers, 6 in.	2	4	4	6
Drill, breast	1	1	2	3
Drill, hand	1	1	2	3
Drill sets, 1/16 to ⅜ in.	1	1	1	2
Figures, set, ¼ in., ⅛ in.	1	1	1	1
Files, assorted	12	12	15	24
Goggles, pair	1	1	1	2
Grinder	1	1	1	1
Hammers, ball peen, small	2	2	4	6
Hammers, claw	2	4	4	6
Letters, set, ⅛ in.	1	1	1	1
Magnets, bar	6	6	8	8
Magnets, horseshoe	6	6	6	6
Mallet	1	2	4	4
Plane, jack	1	1	1	1
Pliers, side cutting, 6 in.	3	5	6	8
Push buttons	6	8	10	12
Receptacle, porcelain	6	8	10	12
Rules, zigzag, 46 in.	2	2	3	3
Saw, compass	1	1	1	1
Saw, crosscut, 10-point	1	1	1	1
Saw, hack	1	3	4	4
Screw driver, 3 in.	2	4	5	6
Screw driver, 4 in.	2	4	5	6
Snap switch, one-way	3	4	5	6
Sockets, push-button	2	3	5	6
Sockets, snap	2	2	4	6
Soldering coppers	3	4	5	6
Soldering coppers, electric	1	1	1	2
Soldering furnace	1	2	3	4
Taps and dies, machine screw, 6-32, 8-32, 10-32	1	2	3	3
Transformers, 8 volt	4	4	5	6
Try square	1	1	1	1
Vise, machinist's, 4 in.	4	6	8	10
Wrench, adjustable	1	1	2	2
Wrench, pipe	1	1	1	1

Graphic Arts (Minimum equipment)

	Number of Students			
Equipment	*5*	*10*	*15*	*30*
Bellows, hand	1	1	1	1
Benzine brush, oval back	1	1	1	2
Benzine can, qt. size	1	1	1	1
Bindery table, 26 by 72 in.	1	1	1	2
Case for reglets and furniture	1	1	1	1
Clothes wringer	1	1	1	1
Composing stick, rouse job, 10 by 2 in.	1	2	2	3
Composing stick, rouse job, 6 by 2 in.	5	8	10	15
Dishpan, large	1	1	2	3
Eyelet punch	1	1	1	1
Flatiron, electric	1	1	1	1
Folding bones, for hand folding	4	6	8	12
Food chopper	1	1	1	1
Galley cabinet, capacity for 25 gal.	1	1	1	2
Galley, all brass, job, 12 by 18 in.	1	2	3	4
Galley, steel, 8¾ by 13 in. (rustproof)	8	12	18	36
Gas burner plate	1	1	1	1
Glue pot	1	1	1	1
Ink knife, square end	1	1	1	1
Linoleum-block cutting tools, 5 tools to set, sets	2	5	8	10
Mailing scale, small,	1	1	1	1
Mallet, hickory or fibered	1	1	1	1
Micrometer calipers	1	2	3	5
Paks, felt, ¼ by 8 by 12 in.	4	8	12	18
Pails, large	3	4	5	6
Pans, rectangular, 8 by 12 by 1½ in.	3	5	6	8
Paper cutter	1	1	1	1
Proof planer, 3½ by 8 in.	1	1	1	2
Proof press	1	1	1	1
Ruler	6	8	10	12
Scissors	4	6	8	10
Slug and lead case	1	1	1	1
Steel straightedges	4	5	6	8
Thermometer, Fahr.	1	1	2	2
Type				
Caslon old style, 12-point, lower and upper case fonts	8	12	15	30
Spaces and quads, 12-point, lb.	16	20	25	30
Leads, 2-point, from 12 to 30 picas, lb. each size	2	4	6	8
Leaders, 12-point, lb.	5	5	8	10
Slugs, 6-point, from 12 to 30 picas, lb. each size	3	5	7	10
Type cabinet, to accommodate 4 pupils, school type	1	2	2	3
Type cases, California job	4	6	8	15
Wooden tables, 36 by 72 in.	2	2	2	3

Transportation (Minimum equipment)

Equipment	Number of Students 5	10	15	30
Anvil, 50 lb.	1	1	1	1
Battery, storage	1	1	1	1
Battery charger, Tungar bulb	1	1	1	1
Battery tester, hydrometer	1	1	1	1
Bench, large	1	2	3	4
Cans, oil, 1/3 pt.	2	4	6	8
Chassis, second hand	1	1	1	2
Chisels, ¼, ½, ¾, and 1 in.	1	1	2	2
Chisels, cold, ½ in.	2	4	6	6
Chisels, cold, 1 in.	2	4	6	6
Combination square	1	1	1	2
Creeper, homemade	1	1	1	2
Dividers, 10 in.	2	2	3	3
Drill, breast	1	1	2	2
Drill, hand	1	2	2	3
Drill set, 1/32 to ½ in.	1	1	2	3
Files, assorted, dozen	1	1	2	2
Furnace, gas	1	1	1	2
Gauge, air pressure	1	1	1	1
Gauge, marking	1	1	2	2
Goggles, set	1	1	2	2
Grease gun	1	1	2	2
Grinder, hand	1	1	1	1
Hammers, ball peen, 1¼ lb.	2	2	3	4
Hammers, ball peen, 2 lb.	1	1	2	2
Hammers, riveting	2	3	4	6
Jack, auto	1	1	1	2
Knives, sloyd	2	3	4	6
Ladle, 3 in.	1	1	1	1
Plane, jack	1	1	1	1
Pliers, combination, 6 in.	3	4	5	6
Pliers, round nose	2	3	4	5
Punches, center	2	2	3	4
Rule, 12 in.	1	1	2	4
Scales, steel, 12 in.	2	2	3	3
Scraper, bearing	1	2	3	4
Screw driver, 6 in.	2	3	4	6
Screw driver, 12 in.	2	2	3	4
Snips, tin, curved, 3 in.	1	1	2	2
Snips, tin, straight, 3 in.	1	1	2	2
Soldering coppers, ½ lb.	2	2	3	4
Tap and die set, machine screw	1	1	1	2
Tire tools, set	1	1	1	1
Try square, 7½ in.	1	1	1	1
Valve lifter	1	1	1	1
Vise, combination	2	4	6	12
Vulcanizer	1	1	1	1
Wrenches, monkey	1	2	3	4
Wrenches, pipe, 12 in.	1	1	2	2
Wrenches, socket set	1	1	1	1
Wrenches, spark plug	1	1	1	1
Wrenches, Stillson	1	2	3	4

Housing (Minimum equipment)

Equipment	Number of Students 5	10	15	30
Awls (assorted sizes) set	1	1	1	1
Benches (double, woodworking) or	3	5	8	15
Benches (single, woodworking)	5	10	15	30
Bits, auger, 3/16 to 1 in., set	1	1	1	2
Bit, expansion	1	1	1	1
Braces, ratchet type	2	2	3	4
Brushes, bench	5	10	15	30
Brushes, glue	6	6	6	6
Brushes, varnish, 1 in.	6	6	6	12
Brushes, varnish, 2 in.	6	6	6	12
Burnisher	1	1	1	1
Cabinet scraper	2	4	5	10
Carving tools, set	1	1	1	1
Chisels, ⅛ to 1 in., set	2	3	6	6
Clamps, bar, 36 in.	3	6	6	6
Clamps, hand, 6 in.	4	4	6	8
Clamps, hand, 12 in.	4	4	6	8
Clamps, malleable iron, C, 6 in.	4	4	4	4
Countersinks	2	4	4	6

Fig. 9. Metal is an interesting medium of expression

Dividers, 6 in.	2	4	4	6
Drills, hand	2	2	4	4
Framing squares, 2 ft.	3	4	4	4
Glue pot, electric	1	1	1	1
Gouges, ⅛ to 1 in., set	1	2	2	4
Grinder	1	1	1	1
Hammers, claw, 12 oz.	2	4	6	8
Knives, sloyd	2	4	6	10
Level, wood, 24 in.	1	2	2	2
Mallets, hickory, 3 in.	2	4	6	8
Marking gauges	2	5	7	10
Miter box, 24 in.	1	1	1	1
Nail sets, 1/16 in.	2	4	6	8
Oil can	1	2	3	4
Oilstones	2	2	3	4
Plane, block, adjustable, 6 in.	1	2	2	2
Plane, jack, 14 in.	3	5	7	10
Pliers, combination, 6 in.	2	4	4	6
Rasps, half round, 10 in.	6	6	8	10
Rules, 2 ft.	5	10	15	30
Saws, back, 12 in.	2	5	7	10
Saws, coping, frames	2	5	5	10
Saws, crosscut, 22 in.	3	4	5	6
Saws, rip, 22 in.	3	4	5	6
Screw drivers, 4 in.	3	3	4	6
Screw drivers, 8 in.	3	3	4	6
Spokeshaves	3	3	4	6
Steel figures, hand cut, ⅛ in., set	1	1	1	1
T bevel, 6 in.	1	2	2	3
Try squares, 7½ in.	2	5	7	10
Turning frames, 14 in.	2	4	5	6
Wheel dresser	1	1	1	1

Metalwork (Minimum equipment)

Equipment	Number of Students 5	10	15	30
Anvil, 50 lb.	1	1	1	1
Bellows, foundry	1	1	1	1
Bench, metalworking	1	2	3	6
Blacksmith's squares	3	4	5	6
Brush, bench	1	3	5	8
Calipers, inside	2	2	3	4
Calipers, outside	2	2	3	4
Chisels, cold, ⅝ in.	2	3	3	4
Chisels, cold, ¾ in.	2	3	3	4
Combination square	1	1	1	2
Crucibles, graphite	1	1	1	1
Dividers, 8 in.	1	1	2	4
Drill, breast	1	1	1	2
Drill set	1	1	1	2
Files, cabinet, 8 in.	6	6	8	10
Files, card and brush	2	2	2	4
Files, flat	3	3	4	6
Files, half-round, double-cut, 8 in.	3	3	4	6
Files, mill, bastard, 10 in.	6	6	8	10
Files, round, bastard, 12 in.	4	4	6	8
File handles, No. 2	6	6	8	8
File handles, No. 3	6	6	8	8
Figures, ⅛ in., set	1	1	1	1
Flask, snap	1	1	1	1
Furnace, melting	1	2	3	4
Gauge, drill and wire	1	1	1	1
Goggles, for machine shop	2	2	3	4
Grinder, hand	1	1	2	2
Grooving tools, set	1	1	1	1
Hammers, ball peen, 16 oz.	3	3	4	6
Hammers, riveting, 12 oz.	3	3	4	6
Hammers, flaring	1	2	3	4
Hammers, setting down	1	2	3	4
Ladles, for melting	1	1	2	2
Letters, ⅛ in., set	1	1	1	1
Oilstone, India, double	1	1	1	2
Pail, galvanized, 12-qt.	1	1	1	1
Pliers, gas, combination 6 in.	2	4	6	8
Pliers, side cutters, 6 in.	1	2	2	3
Punches, center, 3/8 in.	3	3	4	6
Punches, hollow, set	1	2	2	4
Punches, pin, ⅛ by 5 in.	1	2	2	4
Punches, pin, 3/16 by 6 in.	1	2	2	4
Rammer, hand	1	2	2	2
Riddle, foundry, ⅛ in.	1	1	1	1
Riddle, foundry, ¼ in.	1	1	1	1
Rivet set, No. 4	1	1	2	2
Rivet set, No. 6	1	1	2	2
Rule, metal, shrinkage, 24 in. shrinkage, ⅛ in. per ft.	1	2	3	4
Saws, hack, adjustable frames	2	3	3	4
Scribers	2	2	3	4
Shovel	1	1	1	1
Snips, 3 in. straight	3	3	4	6
Snips, 3 in. curved	1	1	2	2
Soldering coppers, with handles, 1-lb. size	3	4	5	6
Spoons and slicks	2	4	4	6
Spray can	1	1	1	1
Taps and dies, U.S.S. ¼ to ¾ in., set	1	1	1	1
Tongs, pick-up	2	2	2	2
Trowel	1	1	2	2

Vises, machinist's	5	5	7	10
Wrench, adjustable, 10 in.	1	2	3	3
Wrench, pipe, 14 in.	1	1	2	2

Ceramics (Minimum equipment)

Equipment	Number of Students 5	10	15	30
Bench	1	1	2	3
Bench, metal, galv. iron top	1	1	2	3
Bowls, mixing, enamel, 1 gal.	3	6	9	12
Brace	1	1	1	1
Drill, star, ⅜ in.	1	1	1	2
Drill, star, ½ in.	1	1	1	2
Glass cutters	5	8	10	12
Jar, stone, large	2	2	3	4
Kiln, electric	1	1	1	1
Knives, putty	5	5	10	12
Knives, sloyd	4	4	6	8
Modeling tools, handmade, asst. set	1	2	3	4
Potter's wheel	1	1	2	4
Riddle, No. 4 mesh	1	1	1	2
Riddle, No. 8 mesh	1	1	1	2
Rules, 12 in.	4	6	8	10
Slicks, spoon	4	6	8	8
Trowels	4	4	6	8
Wire, No. 12, galv., roll	1	1	1	1

Textiles (Minimum equipment)

Equipment	Number of Students 5	10	15	30
Loom, 24 in.	1	1	2	4
Loom, small bench	6	8	10	12
Pans, porcelain, large	3	3	6	6
Scissors, 5 in.	2	2	4	4
Shears, 8 in.	2	2	2	2
Tables	2	2	3	4

Qualifications of Teachers

The teacher is the major factor in the successful functioning of an industrial-arts laboratory. The teacher should be a man who likes to work with boys and who gets along well with boys. The essential training of an industrial-arts laboratory teacher divides itself naturally into cultural, technical, and professional.

The industrial-arts laboratory teacher needs the same culture and refinement that is demanded in all teachers of the system. English, mathematics, physics, chemistry, social science, and the arts should all be familiar ground to the industrial-arts laboratory teacher. Of course it is impossible for the teacher to pursue these courses in general education to their limit but it is highly desirable that he have breadth of view, vision, and appreciation of the world in which he lives. The physical and social sciences are especially valuable as a foundation for an adequate understanding of modern industry and an appreciation of the economic and social environment.

The industrial-arts laboratory teacher needs a technical training as intense as seems practical in the usual four years allotted to the completion of undergraduate work. Courses in drawing, electrical work, metalwork, woodwork, printing, ceramics, and auto mechanics are desirable. Since there are a large number of mechanical trades and a great mass of related information it is not possible to become thoroughly proficient in all. This is no great handicap. Experience indicates that the best teachers of the industrial-arts laboratory are not necessarily tradesmen but men of wide technical training who know how to organize their materials and present them to the class in a clear and forceful manner. However, it is desirable for the industrial-arts teacher to work in industry during the summer in order to keep in close contact with industrial developments and a few years of trade experience are desirable if the teacher also has the cultural, technical, and professional training. No teacher is prepared to handle the industrial-arts laboratory until he has had a thorough grounding in the elements involved in successful teaching. The teacher needs training in psychology, principles of education, history and philosophy of education, and curriculum construction. In addition he should have special methods courses which relate to the organization of the industrial-arts laboratory and industrial-arts education field in general.

Chicago has set up the following requirements for its industrial-arts laboratory teachers:

1. College degree from accredited college or university.
2. Major in industrial-arts education.
3. At least fifteen semester hours of education and psychology.
4. At least ten semester hours of physical science.
5. Two years of teaching experience.

The H. Fletcher Brown Vocational High School

A. B. Anderson

State Supervisor for Trades and Industries, Wilmington, Delaware

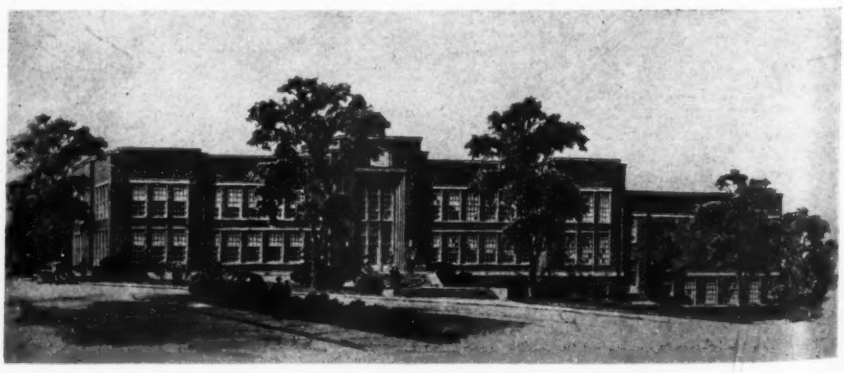
A new 850-student-capacity vocational high school which provides courses on 21 different occupations.

A new vocational school was recently completed in Wilmington, Dela. The H. Fletcher Brown Vocational High School was a gift from two friends of the schools, one of whom, Mr. H. Fletcher Brown, furnished funds for the building and equipment, and the other donor, who prefers to remain anonymous, provided the site. This school will house a large part of the vocational work in Wilmington and vicinity. The school was constructed on a beautiful old estate along the Brandywine Creek, located near the center of the city. The building is three stories with the classrooms and laboratories occupying the front section and the shops occupying the rear section. The school will accommodate approximately 850 students and provide vocational courses for boys and girls in 21 different occupations.

The need for more adequate school-building facilities for the vocational program became apparent in 1931, at which time the board of public education in Wilmington appointed a vocational survey committee to make a thorough study of these needs. On this committee were men representing industry, labor, and the public schools. The recommendations of this committee were largely followed in the plans which were developed.

Grounds

The school, being centrally located, is near the main arteries of transportation from the outlying communities, and is



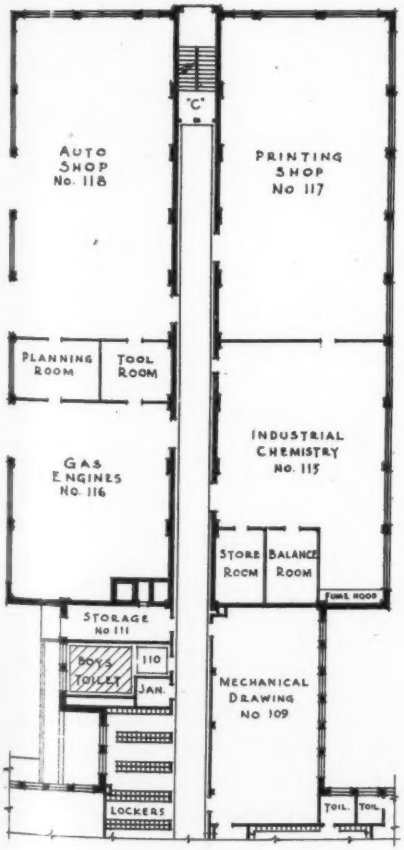
The H. Fletcher Brown Vocational High School

easily accessible for pupils who attend the all-day, part-time, and evening classes. In designing the building, advantage was taken of the slope of the land to provide ground-level entrances for two floors. This adds to the convenience of unloading heavy equipment and materials directly from trucks without the use of elevator or hoist. The slope toward the Brandywine Creek lends itself admirably to artistic arrangement of flowers and shrubbery. Many of the beautiful old trees and shrubs on this property were protected during construction and some will be transplanted to new locations.

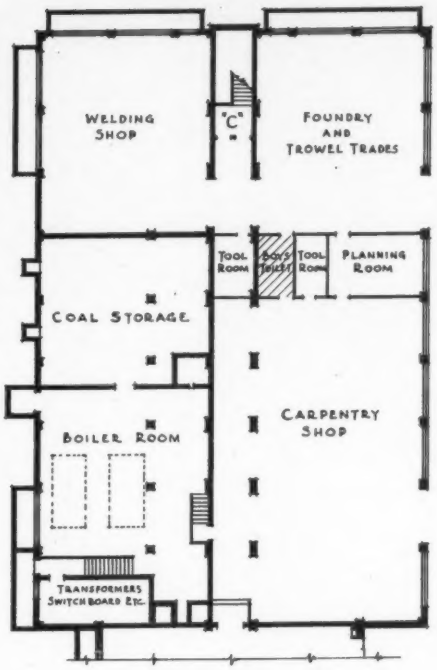
The Building

The building is T shaped, of steel and concrete construction, with red colonial brick walls and limestone trim. It is fireproof throughout. The classroom section, which faces the park is of somewhat standard school construction, while the shop section is of the industrial type of construction. There is a wide approach to the front entrance which has heavy bronze doors and pilasters. The shops are well lighted, having industrial steel sash on the entire outside wall area.

The building contains 12 shops, 19 classrooms and laboratories, a combined gymnasium and assembly room, library, dining room, cafeteria, counselor's room, medical room, and various storage and service rooms. It will accommodate approximately 850 pupils.



First-floor plan



Basement

In the main corridor facing the entrance is a mural depicting the arts and crafts of the Middle Ages. Executed on three levels, it represents master craftsmen and apprentices engaged in characteristic activities. The mural is 24 feet long by 7 feet high.

A display window is located on either side of the main corridor, and special lighting equipment illuminates both the mural and the display windows. The corridor floors are linoleum block tile with walls of buff brick tile and plaster. In addition to the main entrance there are two secondary entrances in the front section of the building, one being on the Fourteenth Street side and the other being adjacent to the auditorium and gymnasium. In the shop section are five large doors for truck service and a secondary entrance.

To provide for future requirements and rearrangement of electrical service, a wireway with "knockouts" has been provided at the ceiling angle on the corridor side of each shop. Sleeves were inserted at intervals of six feet in the concrete floors to enable a conduit or a pipe to be inserted without drilling the floor. New circuits and pipes can thereby be installed in any part of the shops. Water, gas, compressed air, and electrical services are provided throughout the shops and laboratories.

Classrooms and Laboratories

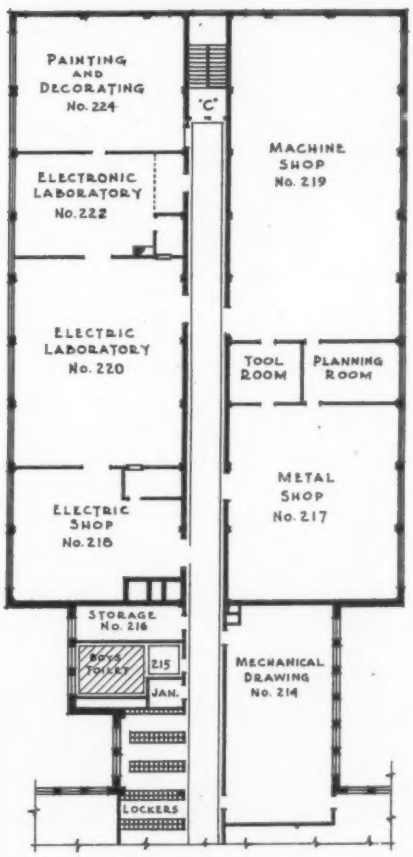
The majority of the rooms are larger than the standard size classroom and vary according to the use for which they are designed. Tables and chairs are standard equipment in all except four classrooms. In three related-science rooms demonstration laboratory tables are provided which are equipped with water, gas, air, and electrical conveniences for experimental purposes.

The combination gymnasium and assembly room is 26 by 64 ft. There is a platform 18 by 33 ft., and two dressing rooms. The assembly room is equipped with 585 folding chairs, storage space for which is provided under the platform. The room is equipped for motion pictures and lightproof curtains are provided for darkening the room. Provision is made for basketball, volleyball, badminton, and other games. Equipment is also provided for the outdoor sports of baseball and football.

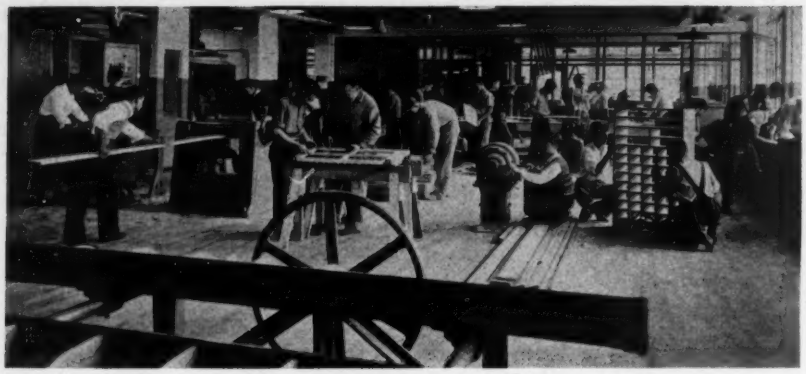
Visual education forms a vital part of the instructional program. The school is equipped with portable motion-picture machines for sound and silent pictures, also a machine for slides and opaque picture projection. Several rooms on each floor have lightproof shades where this equipment can be used in daytime.

Shops

In designing and equipping this building, arrangement for day, part-time, and evening work was planned so that the shops and laboratories could be put to their maximum use at all times. Each shop will accommodate a class of 30 pupils comfortably and without waste space. The heating units are of the fresh-air and recirculating type, suspended at the ceiling to conserve floor space and equipped with blowers to circulate the warm air around the room. Drinking fountains and wash



Second-floor plan



The woodworking shop

sinks are provided in all shops. Each shop is also equipped with a toolroom and storage space. Most of the shops have adjacent planning rooms where pupils may retire from disturbances in the shop to plan their jobs, make sketches, and to look up information required for the job. These planning rooms, each of which will seat about sixteen pupils, are glass enclosed.

Woodworking Shop. The woodworking shop, 44 by 68 ft., is located on the ground floor. It has a hard maple floor. The room is equipped with a table saw, cutoff saw, band saw, mortiser, drum sander, planer, shaper, molder, two speed lathes, sash clamps, automatic saw filer, patternmakers and woodworking benches and vises, and lumber storage racks. An exhaust system is provided with the necessary ducts leading from each machine to exhaust sawdust and shavings so as to provide clean and healthful working conditions in the shop.

Beauty Culture. The beauty-culture room, 23 by 48 ft., is located on the ground floor and has a hard maple block floor. This room, which has a capacity of 30 pupils, has five shampoo sinks, a six-hood-system hair dryer, two portable hair dryers, six manicure tables, three sterilizer cabinets, consoles, chairs, utility cabinets, one Frederic permanent-wave machine, and various pieces of small equipment.

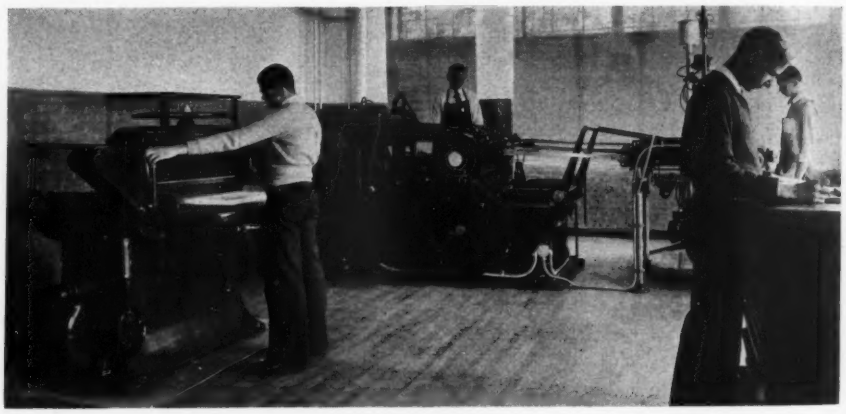
Sewing Room. The sewing room, 25 by 45 ft., is located on the ground floor overlooking the Brandywine. It has a hard maple block floor, is equipped with four large tables, six electric sewing machines, fourteen power sewing machines with individual motor drive, one fitting room, display cabinets, storage cabinets, and three ironing boards. It accommodates 30 pupils.

The sewing room

There is a planning room, 18 by 23 ft. between the sewing and beauty-culture rooms, to be used jointly by these two groups.

Cafeteria. The kitchen is located on the ground floor with a cafeteria on one side seating 280 pupils and a tearoom on the other side with a seating capacity of 30. The kitchen is equipped with the most modern appliances, including a forced-draft fume hood, an electric bake oven, electric mixing machine, vegetable steamer, soup kettle, paring machine, Silex coffee maker, refrigerator, gas stove, a bain-marie, tables, and sinks. In addition there is a large storage room and dishwashing machine.

Foundry and Trowel Trades. The foundry and trowel trades shop is located on the ground floor. It is 35 by 42 ft. It will be used for foundry work in the day school, and for bricklaying and tile setting in the evening school. The foundry has a cement floor and is equipped with a crucible melting furnace, core oven, and tumbling barrel for cleaning castings, grinder, seven molding benches, and pneumatic equipment operated from the compressed-air line. The floor area provided in this shop for evening-school work makes it convenient for setting up sample walls, fireplaces, and other brick and tile work.



Graphic-arts room

Welding Shop. The welding shop, 35 by 40 ft., is located on the ground floor. It has a cement floor. The equipment consists of ten arc-welding machines of different makes and individual booths with exhaust fans to eliminate fumes. The oxyacetylene equipment consists of six stations arranged from manifolds. A grinder and a machine for testing welds are provided.

Auto Shop. This shop, 35 by 68 ft., is located on the first floor, and has a cement floor. A large parking area is adjacent and two doors are provided for admitting cars. The shop is equipped with the necessary bench space and vises, electric automatic lift, electric-eye headlight tester, dynamic wheel balancer, motor analyzer, and various other pieces of testing equipment. A brake-testing machine is supplied by the state highway department. The shop is equipped with an exhaust system for elimination of exhaust fumes when engines are running in the closed room.

A feature of the equipment in this shop is an Oldsmobile cutaway chassis arranged on a stand so as to enable the instructor to revolve it at any angle for demonstra-

tion purposes. A Fisher "sectional" body showing the details of construction is also included. An air compressor is located in this shop and serves not only the auto shop but the entire building where compressed air is used.

Gas Engines. The gas engine shop is adjacent to the auto shop with a planning room and toolroom between. This shop is 35 by 41 ft., and has a cement floor. The equipment consists of a Curtis radial airplane engine, one V-type airplane engine, a Diesel engine, a marine engine, several automobile engines, a LaSalle cut-away-chassis, a Chevrolet chassis, and a complete Pontiac engine unit including transmission and clutch.

The General Motors products in the auto shop and gas engines shop were secured by a friend of the school through the courtesy of Mr. Hugh F. Gallagher.

Printing. The printing shop is size 35 by 70 ft., located on the first floor and has a hard maple floor. The major equipment consists of a No. 1 Kelley press, a C & P Rice automatic unit, a Chandler and Price hand-feed press, a power paper cutter, a Linotype, a Baum automatic folding machine, composing-room saw, paper drill, stapling machine, proof press and various cabinets, type cases, composing stones, and smaller equipment.

Industrial Chemistry. The chemistry laboratory, 35 by 54 ft., is located on the first floor. It has a composition acidproof tile floor. This laboratory contains the industrial type of equipment. It has three steel tables, 5 by 22 ft., each with acidproof lead top, Alberine stone top, and remote controls for gas and air. There are also titration tables and a fume hood of the same type of construction. The major equipment consists of analytical balances, electric furnaces, a Beckman glass electrode meter, distilling apparatus, ball mill, electric drying oven, viscosimeters, and water bath. A special feature of this laboratory is the safety shower and fume hood. There is also a balance room and storeroom. Much credit is due the chemistry advisory committee for this carefully planned laboratory.

Machine Shop. The machine shop is located on the second floor. It is 35 by 68 ft. in size and has a hard maple floor. The major equipment conists of two milling machines, radial drill, two drill presses, ten lathes, planer, shaper, about 80 feet of bench space, and 20 vises. There is a planning room and toolroom in connection with this shop; and a hardening and heat-treating furnace is available in the adjoining shop.

Plumbing and Metal Shop. The plumbing and metal shop is located on the second floor. It is 35 by 41 ft. in size and has a hard maple floor. A large fume hood with forced draught is located on one side of the room. Double-deck booths are provided for making plumbing installations, and water and sewer connections are available. This shop is to be used part time for sheet metal also, and contains such equipment as benches, folding machine, brake, bar folder and various forming machines, drilling machine, and an assortment of smaller sheet-metal equipment. A melting furnace, heat-treating furnace, forge and soldering furnaces are installed under the fume hood. Thermocouples are a part of the equipment of the furnaces.

Auto-mechanics

Electric Laboratory. The electrical section occupies three rooms; a shop, a laboratory, and an electronics room. These are located on the upper floor and are provided with a trench or "wireway," which is near the walls and recessed in the floor. These trenches make it possible to lead various electrical circuits from the switchboard to the outlet panels or control desk where the desired equipment can be plugged in. The metal partitions are glazed from three feet above the floor to give an unobstructed view from one room to the next. The floors are hard maple.

The shop is equipped with a small lathe, drill-press grinder, arbor press, wiring booths and various small equipment for bell and house wiring, for making repairs, and for building equipment. The shop is 35 by 28 ft. in size.

The testing laboratory contains the main distribution board and five distribution control desks. The equipment consists of various motors, generators, torque dynamometer, rotors, switches, transformers, loading resistors, capacitors, tachometers, rheostats, and a large variety of meters. Three steel bed plates, about 3 by 5 ft. each, are placed in the floor for fastening down motors and other equipment to be tested and repaired. The laboratory is 35 by 40 ft.

The electronics room, which is 35 by 26 ft., is equipped especially for radio work; however, the tubes, meters, and other equipment will lend themselves to use for television when the need arises. Much of the equipment consists of tubes, condensors, control equipment, resistors, switches, and a large variety of meters. Most of the sound equipment and radios will be built in this laboratory. The antenna is constructed on the roof of the building and leads into this room.

Merchandising. The merchandise unit has three rooms and a store layout fully equipped. The merchandise room and store is 52 by 33 ft. The display laboratory is

Commercial-art class in H. Fletcher Brown Vocational School

40 by 33 ft., and the show-card laboratory is 38 by 33 ft. There are two display windows in the main-entrance corridor, one 14 by 6 ft., and the other 14 by 3 ft. The merchandise classroom and store is equipped with tables and chairs, Toledo scales, measuring machines, cash register, wrapping equipment, marking machine, showcases, counters, back shelving, and cabinet space for hanging merchandise. The window- and store-display laboratory is equipped with one platform, window size, and seven folding platforms used for window-trimming practice. The laboratory is fully equipped with window- and store-display equipment such as manikins, forms, and stands of various descriptions. The show-card laboratory is equipped with art tables, brushes, paints of every description used in show-card work including complete air-brush equipment.

High-School Industrial-Arts Program

F. L. Schlagle
Superintendent of Schools,
L. E. Falgren
Supervisor of Industrial Arts,
Kansas City, Kansas

A description of the shop courses offered at Wyandotte High School, Kansas City, Kansas.

The new Wyandotte High School, dedicated September, 1937, is a typical cosmopolitan high school. The industrial-arts department has been organized on a unit basis, yet each unit is developed in a general way to serve all the students of this section of the city. The courses offered are woodworking, general metal, electricity, printing, general drawing, and auto mechanics.

General Woodworking

The woodworking course is made up of the following general teaching units: Shop organization and safety lessons, the planning, making and reading of working drawings; benchwork; care and maintenance of shop equipment; power machines — their uses and safety factors; surface decoration; wood turning; wood finishing; upholstering; wood technology and wood uses; furniture repair; and factory production methods.

The physical layout of the laboratory includes a room, 30 by 66 ft., for workbenches and power machines; a lumber room; toolroom; teacher's office; finishing room; finishing storage room, and project-storage room. The large room is equipped with 26 specially built workbenches of our own design, five lathes, band saw, jointer, surfacer, belt sander, mortiser, circular saw, jig saw, shaper, and oil grinder. Large sections of windows provide an abundance of natural light. The lumber room contains large pipe racks for lumber storage. The finishing room is equipped with a fireproof metal cabinet for finishing materials and a spray booth for spray-gun finishes. Two sloping panels are on each side of the toolroom for mounting hand tools, and a built-in cabinet for nails, screws, and supplies is located in the back of the room. Figure 1 shows location of the workbenches and power machines.

General Metal

The teaching units offered in the general-metal course are: Sheet metal, sheet-metal development and planning, art metal, ornamental iron, foundry, machine shop, forging, welding, and metal cleaning and finishing.

The complete laboratory includes a

Fig. 1. Location of workbenches and power machines in the woodworking department

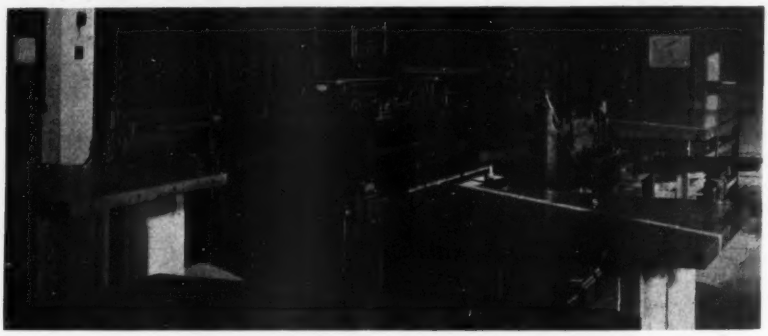


Fig. 2. Sheet-metal section of the general metal laboratory

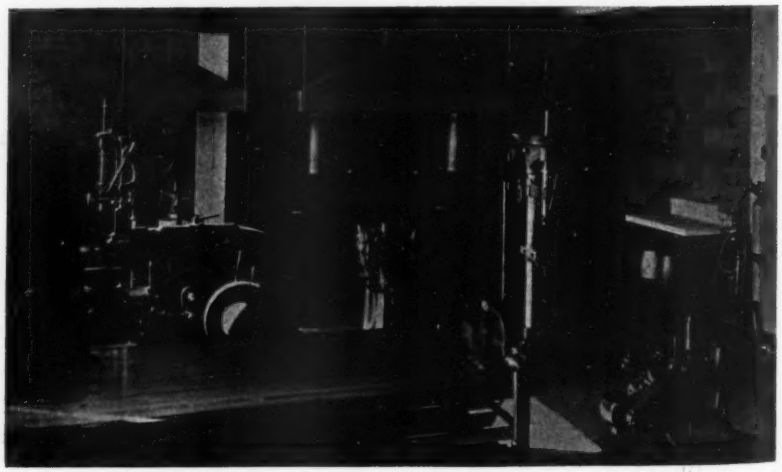


Fig. 3. Machine area of the general metal laboratory

Fig. 4. Machine area of the general metal laboratory

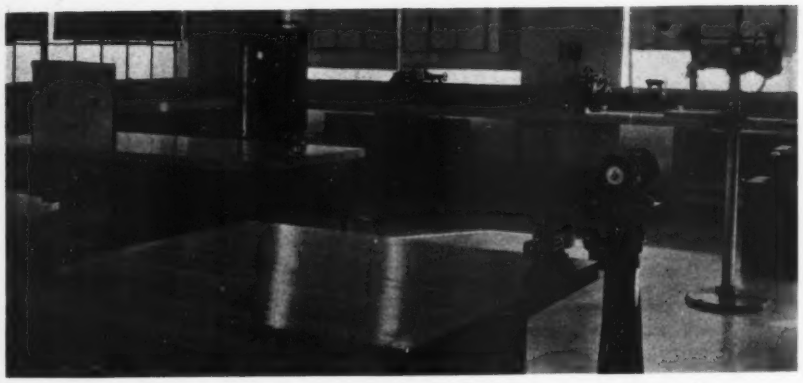
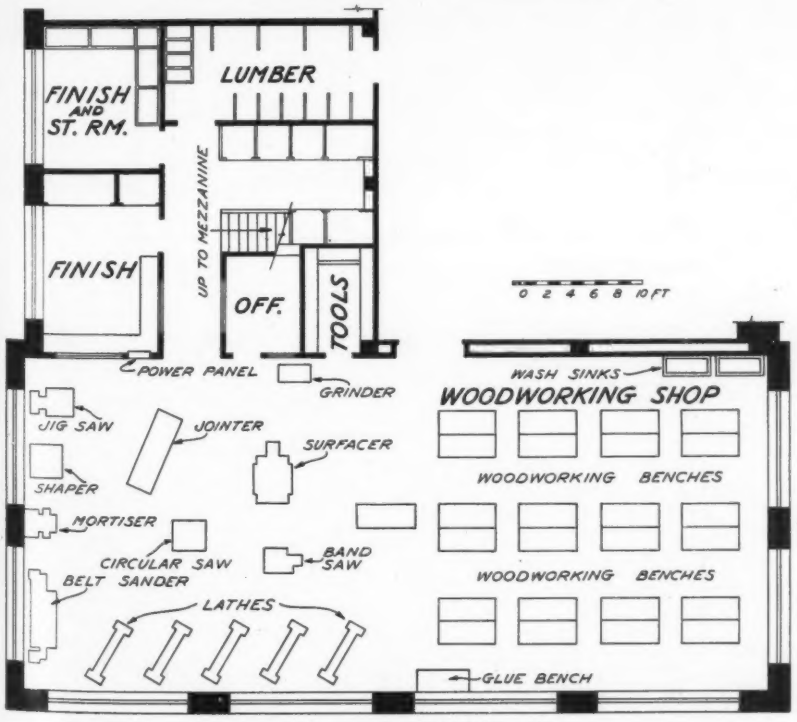


Fig. 5. Machine area of the electrical laboratory



Layout of general woodworking shop

room, 30 by 84 ft., for sheet-metal tables, student workbenches, and general machine area. In addition there is a finishing room, a toolroom, a supply room, and a teacher's office. The large room is equipped with three large sheet-metal tables for sheet-metal stakes and machines, and sheet-metal brake and squaring shears. See Figure 2. The center of the room is equipped with 16 student worktables with vises, and a heavy-duty strap-iron bench. Four machine lathes, two grinders, power hack saw, shaper, two drills, foundry furnace, two forges, and acetylene-welding equipment are found in the general machine area. See Figures 3 and 4. The finishing room includes a spray booth for air-spray finishes. The toolrooms in all of the laboratories are equipped with sloping-panel tool boards for hand tools. An especially constructed supply room was built for general metal supplies. The teachers' offices are similar in all laboratories, the main equipment being a teacher's desk, a two-drawer file, shelves for library books, and a large steel wardrobe cabinet.

General Electricity

The electrical course is made up of the following general teaching units: Care and maintenance of shop equipment, shop organization and safety lessons, planning, kinds and sources of electricity, magnetism, practical uses of electricity, conductors and insulators, units of measurement, methods of control, safety measures, and radio construction and repair. Many practical projects are made as these general units are studied, in order that the students may learn the practical applications of these fundamental principles.

The layout of the laboratory includes a room, 30 by 66 ft., in which are located the demonstration chairs, workbenches, and power machines. There also is a teacher's office, and a tool and supply room. The main room is equipped with 30 tablet-arm chairs, an instructor's electrical demonstration table, 18 workbenches with machinist's vises, electrical layout table, electric grinder, electric drill, two machine lathes, and complete motor generator equipment. The toolroom not only provides sloping panels for hand-tool equipment, but also has special built-in cabinets for electrical supplies and experimental apparatus. Figure 5 shows the electrical machine area.

Printing

The general teaching units offered in our elementary and advanced printing courses are: History of printing; principles of typesetting; proving composition; style aids in composition; elementary and advanced stonework, platen press, tabular work, selection of types, borders and ornaments; principles of display; business stationery; commercial forms; publicity forms; social forms; finishing operations; paper uses and manufacture; and cylinder press make-ready and feeding.

The complete laboratory consists of a room, 30 by 66 ft., containing type

cabinets and general printing equipment. In addition, there is an office, a toolroom, and a stockroom. The main room is equipped with 8 modern type cabinets, proof press, 2 imposing tables, 4 platen presses, cylinder press, drying rack and stock table, and a large circular wash-basin. The toolroom is constructed especially for printing tools and equipment. A stitcher, stapler, electric paper cutter, and especially built storage cabinets are found in the stockroom. Figure 6 shows the printing-press area of the laboratory.

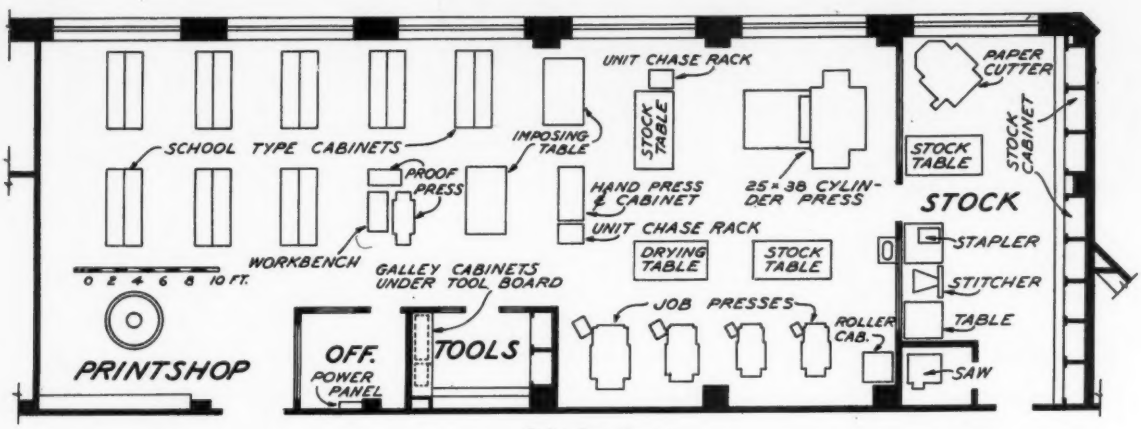
Fig. 6. Modern type cabinets and press area of the printing laboratory

General Drawing

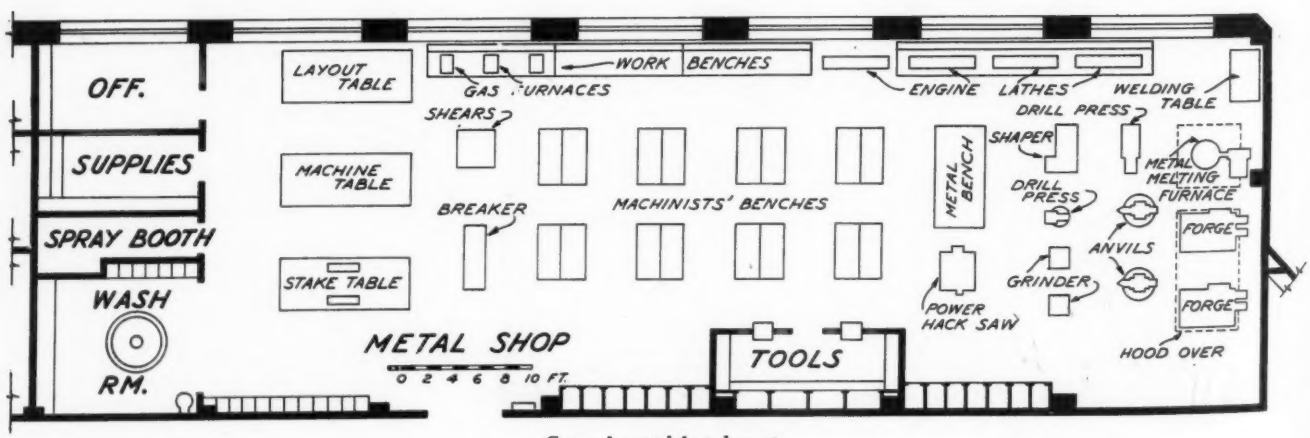
The general teaching units offered in our drawing department are: Lettering; care and use of drawing equipment, orthographic projection, freehand sketching, charts and diagrams, sheet-metal development, making and reading working drawings, machine drawing, architectural drawing, and perspective.

We have two general drawing laboratories. Each has a large room with 40 especially built drawing tables, a large storage room with built-in cabinets designed especially for storage of drawing supplies and equipment. One of the laboratories has a blueprint room equipped with an electric blueprinting machine and blueprint washer. Figure 7 shows one of the drawing laboratories.

Fig. 7. General drawing laboratory



Printshop layout



General metalshop layout

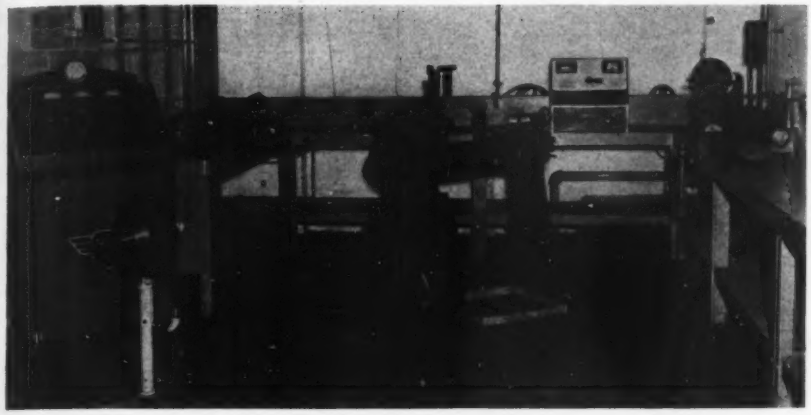


Fig. 8. Electrical testing room in the auto-mechanics laboratory

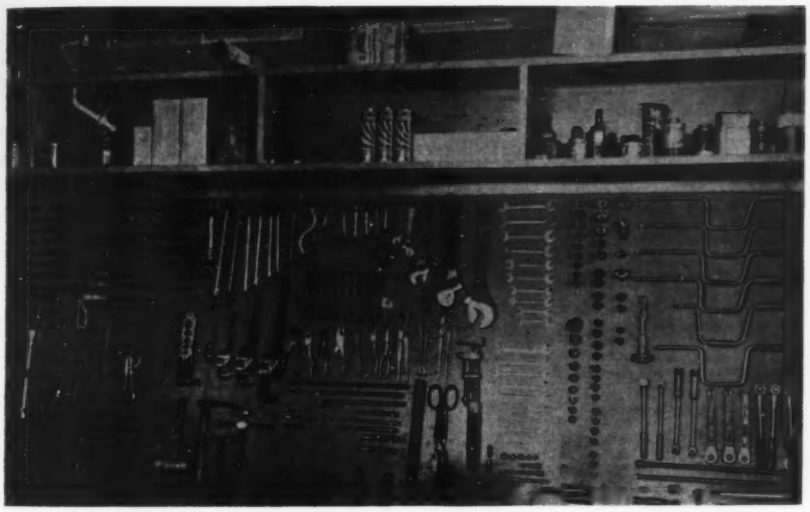
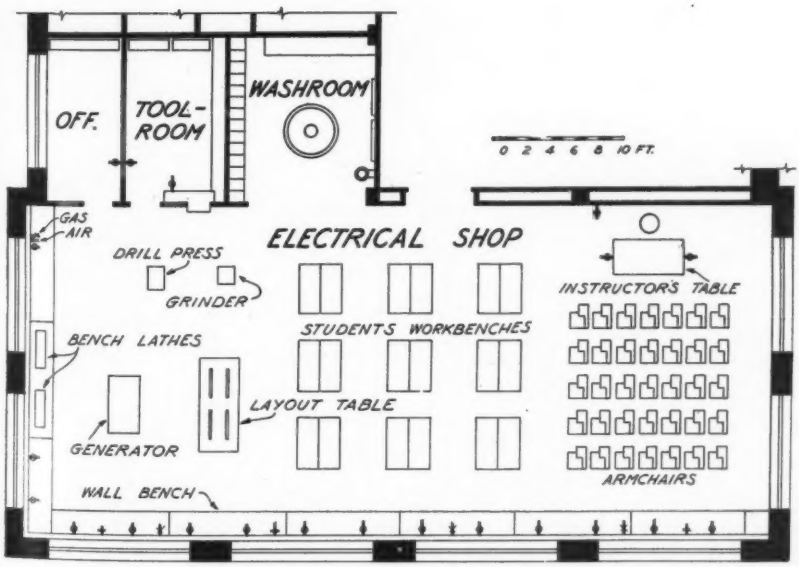


Fig. 9. Auto-mechanics toolroom



Layout of general electricity shop

Auto Mechanics

(See shop layout, top of page 114)

The auto-mechanics course offers the following teaching units: Accident prevention and traffic regulations, auto-shop tools and equipment, auto-shop organization, development of power in an automobile engine, transmission of power in an automobile, control of an automobile, automobile servicing, auto electrical system, measuring instruments, and engine reconditioning.

The complete automotive laboratory includes a large room, 30 by 66 ft., toolroom, locker and washroom, office, and an automotive electrical testing room.

The large room is equipped with worktables, washrack, and traveling crane and hoist. Several cars can be accommodated here. The toolroom is especially built for automotive tools. A large round washbasin and steel lockers in which students store work clothes are part of the equipment in the locker and washroom. In the electrical testing room are located a machine lathe, valve refacer, battery tester and charger, armature-testing equipment, wheel aligner, grinder and buffer, motor analyzer, and other motor-testing equipment. Figure 8 shows the electrical testing room, and Figure 9 the toolroom.

INDUSTRIAL ARTS IN A NEW JUNIOR HIGH SCHOOL

Wayne M. Judy and Oscar Sontag, Backus Junior High School, International Falls, Minnesota

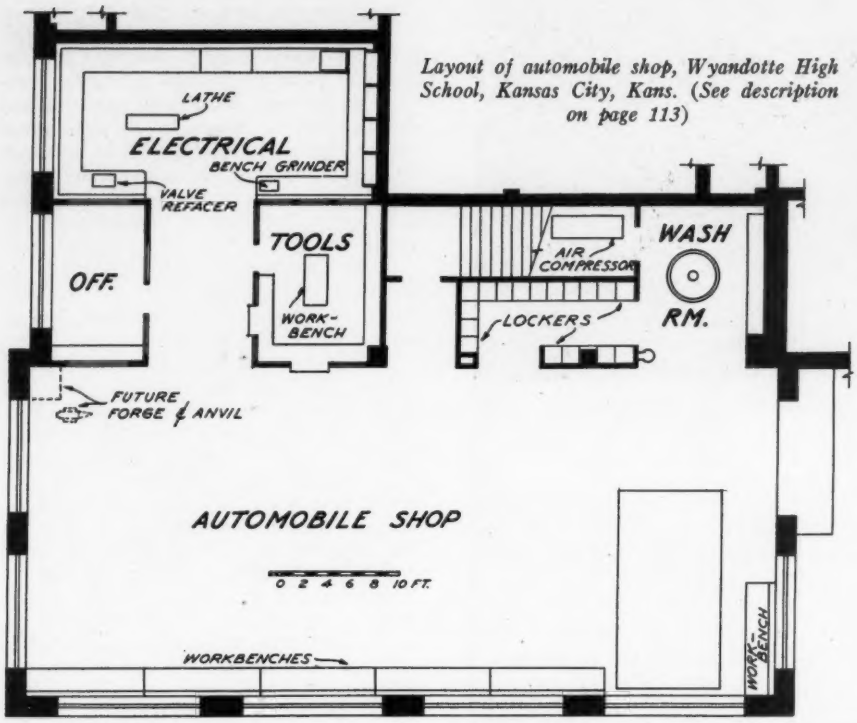
A description of the shop layouts for industrial-arts work in the new junior high school at International Falls, Minnesota.

Because of crowded conditions and inadequate laboratory facilities, the citizens of International Falls decided in 1935 to build a new junior high school. The result of this decision now stands as a monument to the forward-looking people of the community who made its erection possible. It is the new $391,000 Backus Junior High School.

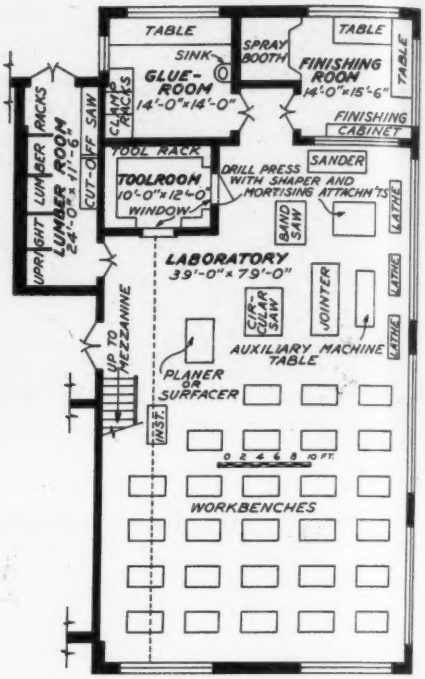
The main floor of this building, 120 by 190 ft., is given over to an auditorium, gymnasium, the home-economics department, the industrial-arts department, and the offices.

Of the 22,800 sq. ft. of floor space on the main floor, 3,631 ft. is utilized by the industrial-arts department. These 3,631 ft. are divided into a drafting room 23 by 33 ft., a demonstration room 24 by 24 ft., two offices 6 by 10 ft., a workshop 33 by 60 ft., which includes a lumber room 12 by 22 ft., and a finishing room 12 by 16 ft. In addition to the above, there is a miscellaneous storage room 14 by 14 ft.

The department is planned on the two-instructor basis, with equipment and facilities for two classes of 30 students each.



Layout of automobile shop, Wyandotte High School, Kansas City, Kans. (See description on page 113)



Layout of woodworking laboratory, Northeast Junior High School, Kansas City, Kans. Harold M. Gray, Instructor

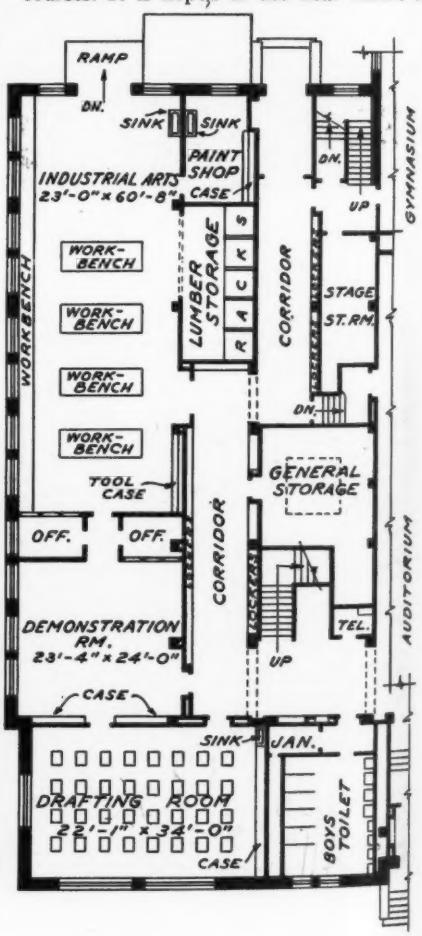
The schedule is so arranged that there can be no conflict between the two sections. This is possible because when one class is scheduled for the shop, the other is scheduled for either the drafting room or the demonstration room.

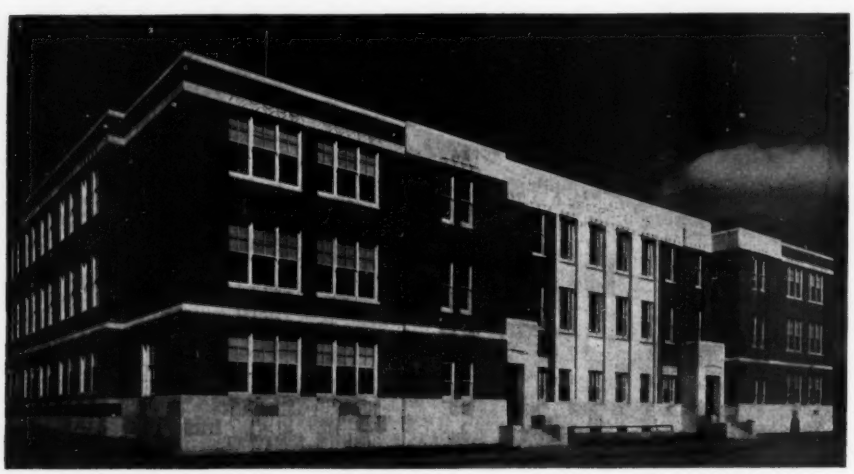
The per-pupil floor space was planned on a 60-sq.-ft. basis. However, in actual practice this area is larger because every effort is made to keep classes down to twenty-four students per section. This is done upon the recommendation of the Minnesota State Department of Education whose policy is to limit industrial-arts classes to a maximum of twenty-four students, thus facilitating more individual instruction.

Ninety-eight per cent of all boys enrolled in the Backus Junior High School elect to take the industrial-arts course. They are given five-hour periods per week in grades, seven, eight, and nine. At the present time there are 225 boys taking advantage of this opportunity. These boys are offered the following courses:

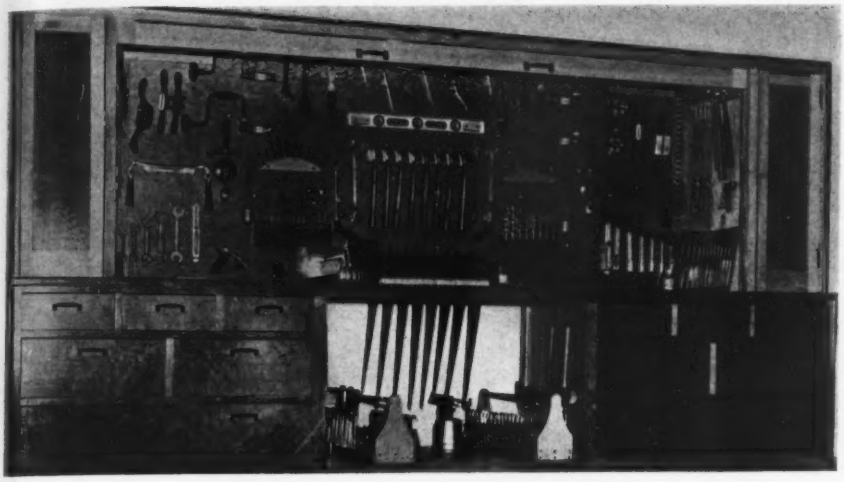
7th grade — 24 weeks of general mechanics
12 weeks of elementary electricity
8th grade — 18 weeks of woodwork
18 weeks of drafting
9th grade — 18 weeks of drafting
18 weeks of woodwork

A student completing the junior-high course of study and electing to take the industrial course in the high school is given work in advanced drafting, metalwork, advanced woodwork, and trade-relationship courses. It is hoped in the near future to





Backus Junior High School, International Falls, Minn.



Built-in tool cabinet designed and built by Wayne M. Judy and Oscar Sontag, instructors

add a part-time continuation course to the present curriculum.

The Backus Junior High School shop is equipped throughout with new tools, machines, and desks of the latest design and construction. Outstanding in this connection is the combination electrical and general-mechanics bench, the mechanical-drawing storage cabinet and the 5 woodworking benches. These three items were designed by Mr. H. T. Widdowson, State Supervisor of Industrial Education.

The general-mechanics and electrical bench is designed to accommodate 30 students at one time. Each student has at his work space, a 6–12 volt and a 110-volt outlet in addition to an electrical mounting board and 5 drawers for storage space. When the installation is complete there will be a 3-in. mechanic's vise for every two students.

The woodworking benches are designed especially to facilitate the class unit type of instruction. That is, each bench accommodates six students with ample work and storage space for each. These six students make an ideal group for one student foreman. This type of instruction is used because it conforms more closely to the working conditions as found in the community than any other one type.

The mechanical-drafting cabinet is very compact, usable, and quite adequate for six sections of 30 students per section. It is so arranged that each student has individual locker space which is large enough for his drafting board, T square, scale, paper, ink, and other miscellaneous items. Besides these lockers there are ten large compartments which are used for storage of general drafting equipment, instructional aids, supplies, and the like.

The demonstration room is equipped for 30 students. It is especially designed for teaching of related information. Ample blackboard space, classroom desks, a demonstration desk, and complete equipment for visual education are features of this room. In connection with the demonstration room, book space is provided for a shop library. This book space is large enough for a library of three thousand volumes, plus ample space for periodicals.

Power equipment

Partial view of drafting room showing special storage cabinet

All in all the citizens of International Falls are very proud of the industrial-arts and vocational-education departments. They are fully justified in this pride, for their departments, although not elaborate, are quite complete. Much credit for such a complete setup must go to Superintendent J. A. Sathrum and the board of education who were among the first to realize that purely academic courses were not adequately equipping the graduates of their schools to meet the problems of life as found in this community. With this in mind, these men have constantly worked toward the setup which is now in actual operation. Industrial-arts education needs many forward-looking men of this type if it is to continue to grow and fill the place in the field of general education for which it is rightfully qualified.

A tool is but the extension of a man's hand, and a machine is but a complex tool. And he that invents a machine augments the power of a man and the well-being of mankind. — *Henry Ward Beecher.*

A New Industrial-Arts Building

S. L. Coover

Director, Industrial Arts Department,
State Teachers College,
California, Pennsylvania

A layout for a teacher-training industrial-arts department.

The new $200,000 industrial-arts building was occupied February 1, 1939. It was built by the Pennsylvania General State Authority in co-operation with the Federal Government to house the industrial-arts department of the State Teachers College, at California, Pa. The building was designed by architects Marks and Simboli, Pittsburgh, Pa. The new building was made necessary by the rapidly increasing enrollment in this department which has grown from 20 students in 1930, the first year of its organization, to 225 full-time students for the present school year.

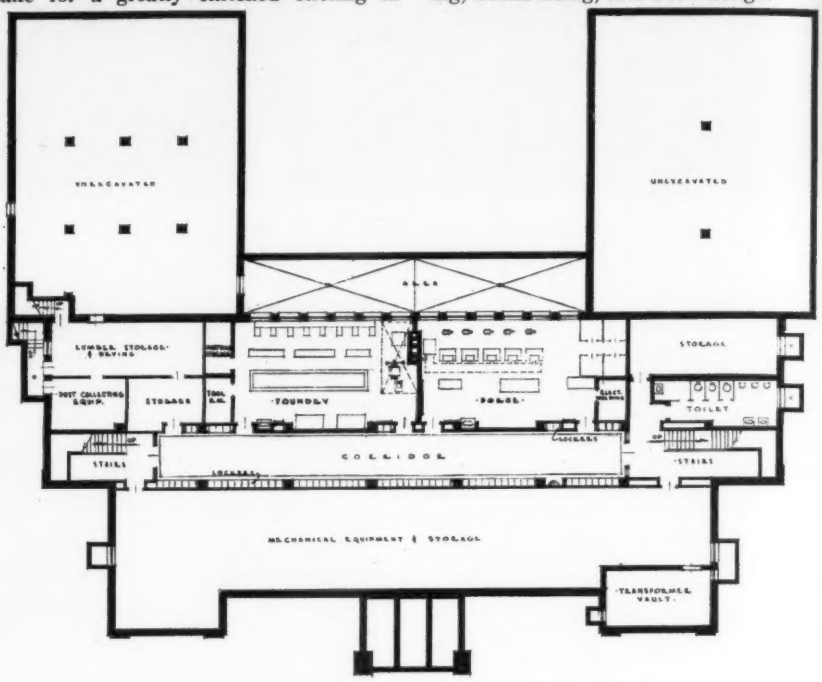
The architecture is colonial in style in keeping with the other buildings on the campus. The main part of the building is two and a half stories high, and measures 176 feet in length by 67 feet in width. In addition, there are two one-story wings measuring 51 by 67 feet, providing a total of more than 38,000 square feet of floor space.

The building houses twelve shops: Wood, paint, machine, sheet metal, forge, welding (electric and acetylene), auto-mechanics, electric, ceramics, graphic-arts, and a secondary-school demonstration general shop. Two large drafting rooms, a blueprinting room, a reference library, a planning and design room, as well as classrooms, offices, and storage rooms are included in this spacious building.

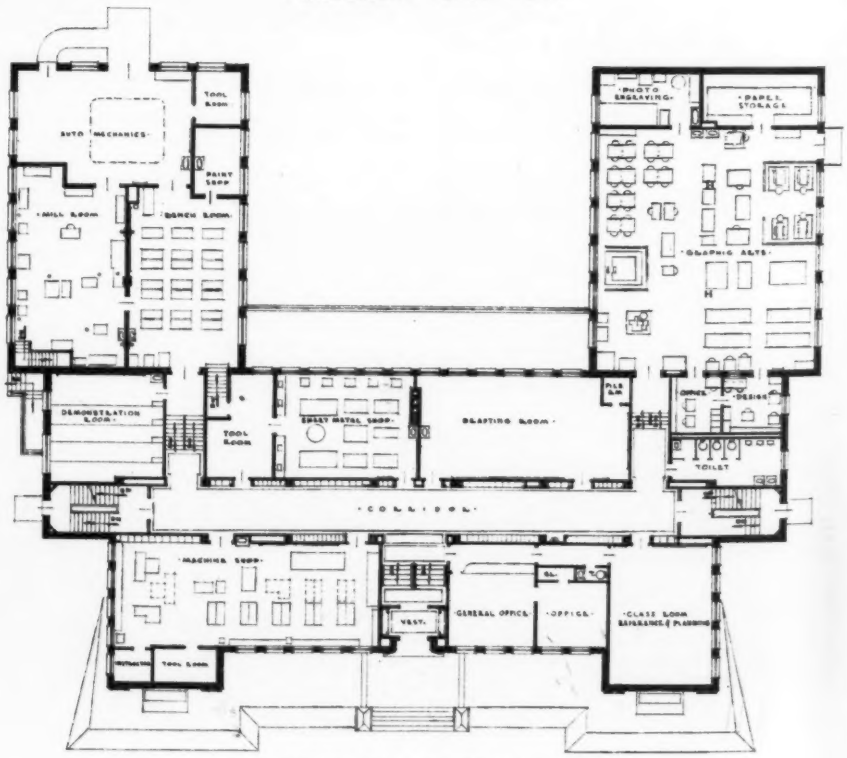
The building has several features which were specially planned for industrial-arts teacher education. Adequate space has been provided for office and conference rooms. The library, research, and planning room is conveniently located on the first floor where it is easily accessible to those regularly using the building as well as other students whose problems relate to the industrial-arts field. Another unusual feature is the large size lockers, 18 by 18 by 72 in. This size locker provides adequate storage space for partially completed work. There are 250 of these built-in lockers along the corridors of the three floors, and 44 additional 18 by 18 by 18-in. lockers opening into the machine shop. In order to facilitate class scheduling, there are two large drawing rooms with auxiliary storage rooms and one blueprinting room.

While the shoprooms were planned to house the particular units as shown on the accompanying floor plans, special service lines — water, gas, electric, and compressed air — have been included in all shops and storage rooms to facilitate future changes. Electric wall outlets are located at 4-ft. intervals around the shops and demonstration rooms.

The graphic-arts laboratory will include new and complete equipment that will make for a greatly enriched offering in this field. Many phases of the graphic arts other than letterpress work will be available. To be included are: Papermaking, linoleum and wood cutting, silk-screen printing, dry-point and soft-ground etching, bookbinding, and book design.

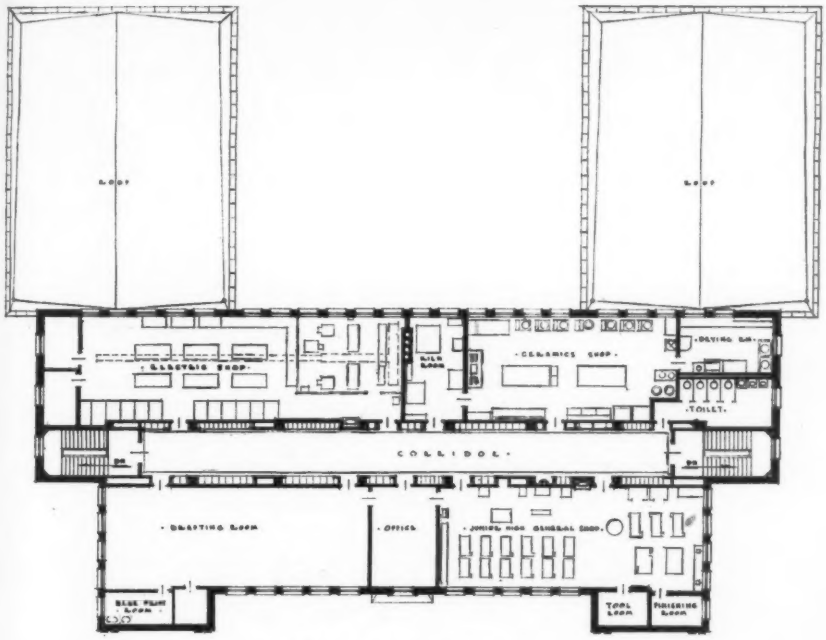


· BASEMENT FLOOR PLAN ·

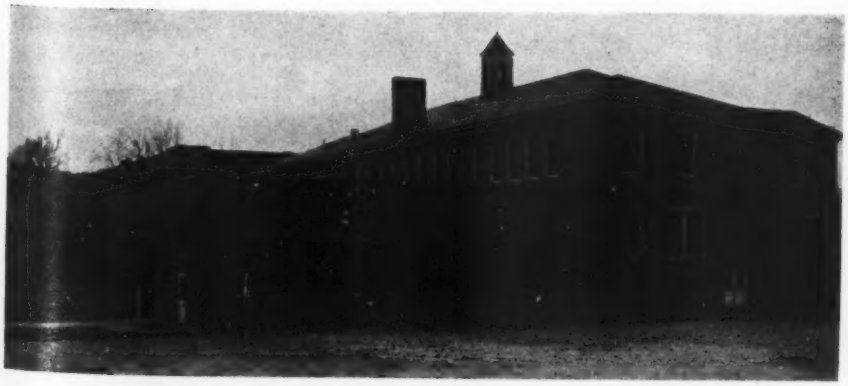


· FIRST FLOOR PLAN ·

Front view, Industrial Arts Bldg., State Teachers College, California, Pennsylvania



· SECOND FLOOR PLAN ·



Graphic-arts wing, Industrial Arts Bldg., State Teachers College, California, Pennsylvania

An adjoining design and editorial room, with reference material for research, allows the students to prepare necessary editorial and artwork. A large stockroom provides ample space for a varied supply of paper and other materials.

New automatic presses will facilitate the handling of publications of the industrial-arts department. A room equipped with complete photoengraving equipment, will make it possible for the student to prepare actual cuts from photographs and line drawings.

The secondary-school demonstration center will greatly facilitate student teaching and observation work. Here it will be possible for teachers in preparation, to have first-hand contacts with industrial-arts teaching very early in their college work. This shop will also provide the opportunity for students to participate in refining ideas and plans worked out in college classes. It is observed that graduates tend to teach as they were taught and as they observe others teaching. For this reason a good demonstration center is an excellent means for stimulating better teaching.

The reader should observe that a drawing room, an office for conferences, and a ceramics laboratory are on the same floor. These rooms are to supplement the one set aside for demonstration work. For this reason, unnecessary duplication of equipment has been avoided.

The building was planned to accommodate from 350 to 400 full-time industrial-arts students. The laboratory work in the industrial-arts four-year curriculum requires work in eight different shops with a total of 14 semester hours. Five of these drawing and design courses run concurrently with the shop courses which they are planned to supplement.

Storage cabinet. Don L. Olson, Public Schools, Dawson, Minn.

Miscellaneous

Home Mechanics in the Chicago Public Schools

William H. Johnson

Superintendent of Schools, Chicago, Illinois

A clear presentation of the type of shopwork Chicago is now offering the seventh- and eighth-grade pupils in its public schools.

Life was largely rural in the early development of our country. There were few large cities, factories were undeveloped, transportation and communication facilities were meager. The comforts and luxuries that the development of the machine in industry and the home have made possible were unknown. It took most of the pioneer's energy to conquer the wilderness, establish a home and provide food, shelter, and clothing.

The pioneer household provided most of the necessities and luxuries of life through the hand labors of its own members. The pioneer housewife spun the yarn and wove the cloth to meet the clothing need of the family. She preserved food for the winter, made candles, made soap, and churned butter. The pioneer husband butchered and cured their meat and raised the grain from which his wife baked their daily bread. The children out of necessity learned how to do these many household tasks from their parents or from neighbors.

Needs of Today

Today the complexity of our environment has increased a thousandfold and the responsibilities and methods of providing the necessities and luxuries of life have changed. This change is greatest in large urban areas like Chicago although the changes in the rural areas are almost as great. Transportation and communication have made tremendous strides along with industries, new scientific discoveries and the inventive genius of our people have provided us with new and better ways of living. Specialization has taken over at least in part many of the tasks that were done in the home in pioneer days. Our cloth is made in textile mills, and most of our clothing is purchased ready made. The laundry is ready to wash and iron our clothes at a nominal cost. Much of our winter food supply is canned commercially or is shipped in refrigerator cars from the more tropical areas. We have a choice of coal, oil, or gas for our winter's fuel. The pioneer had to spend two or three weeks in the forest with ax and saw to get his winter's fuel. Today the average urban dweller simply telephones the merchant and his winter's fuel is delivered.

The automobile and modern highway have given us an economical form of transportation, undreamed of in pioneer days. A trip that would take our pioneer ancestors a full day with their oxen or horses over dirt roads can now be accomplished easily in less than an hour. The modern transport plane has revolutionized our ideas of space and time in our own generation.

Electricity has freed the modern housewife from many tasks. For example, electricity lights our homes, operates our radios, vacuum cleaners, refrigerators, air-conditioning equipment, irons, doorbells, and clocks.

The modern plumbing system provides us with hot or cold water at the turn of a tap and carries away our wastes. It contributes to the convenience and sanitary conditions in modern life.

All of these developments have resulted in better living conditions, better health, and more leisure for everyone. However, to get the most satisfaction and service from the equipment of the modern home, requires the development of consumer knowledge and simple handyman abilities with tools and materials. The modern boys and girls do not have the opportunity to learn the essentials of home maintenance in the realistic way that the children of the pioneers did. The pioneer boy and girl learned to make candles, weave cloth, make soap, and tan leather in the home. The modern boy and girl are not confronted so much with the making of items, but they must be intelligent consumers of the many hundreds of commercial products that are clamoring for their attention and they must understand the care, repair, and use of the many mechanical servants and appliances in and about the home if they are to be intelligent members of the modern family.

Some parents do teach their children a great deal about the care, intelligent use, and adjustment of the many mechanical devices about the home, but the vast majority do not have the time, or in many cases, the inventions and improved devices have come into general use without any comprehensive understanding on the part of the parent of their underlying principles and maintenance operations.

Since the experience that boys and girls get in the modern home does not give them adequate handiness with common tools or sufficient consumer intelligence about the products of industry for the efficient operation of a modern home it has become a general practice in the schools of the United States to teach boys and girls in

Girls who know how to make circuit diagrams

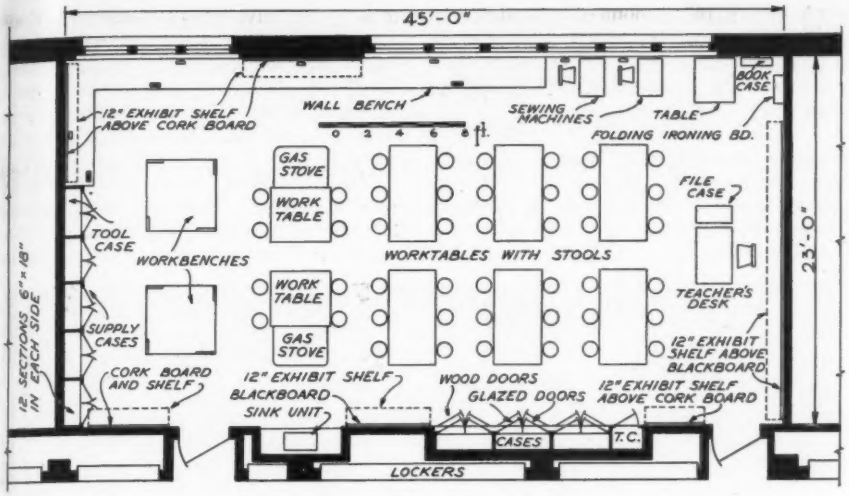


Fig. 1. Plan of home-mechanics room for elementary schools

school essential handwork skills and consumer information.

The New Home-Mechanics Course

The Chicago public schools have developed a new handcraft course for boys and girls in the seventh and eighth grades called *home mechanics*. This new course of study in home mechanics for boys and girls is the result of several years' study and experimentation to find a handcraft course for the upper grades of the elementary school that would make a real educational contribution in line with modern needs. The content of the Chicago home-mechanics course is based on surveys, study of procedures in other progressive cities, and experimental testing of the course content in Chicago's elementary schools.

The home-mechanics course is designed to replace the old courses in manual training and domestic science which became obsolete and were dropped from the curriculum in 1933. The older handcraft courses put the emphasis on tool operations and a limited number of construction materials. These old courses were the result of pioneer attempts to provide the needed instruction in handwork to help boys and girls make the proper adjustments to our new mechanical and industrial world.

In discussing manual training in 1923 Dr. Bonser[1] wrote "Investigations of the courses proposed and taught in our schools leads one to note these prominent inadequacies in manual training:

"Want of relationship of the work to life. The sequence of the models was in terms of tool processes.

"Failure to provide for the individuality of the child. Each must conform to the system.

"Lack of motivation. The work was all prescribed in a fixed course.

"Placing the emphasis upon the product as the objective, rather than upon the growth of the child."

[1]Bonser, F. C. and Mossman, L. C., *Industrial Arts for Elementary Schools*, The Macmillan Company, 1923.

Writing in 1926 Professor Friese[2] states "The term 'manual training' is not obsolete but there can be no denial that in the past few years it has fallen into disuse quite generally. A survey of the present day literature will reveal this fact."

Home-Mechanics Objectives

The broad objective of the new Chicago home-mechanics course is general education. The specific objectives are:

1. To give consumer knowledge about the selection and use of the products of industry.
2. To develop handyman abilities with common hand tools and a variety of construction materials.
3. To promote the use of handcraft for leisure-time activities in the home.
4. To contribute to the development of the personality of the child and to further the social objectives of general education.

Home-Mechanics Content

The instructional divisions of the home-mechanics course are presented in the seventh and eighth grades as follows:

Seventh Grade — First Semester

1. The reading and making of simple work drawings.
2. Care and use of hand tools.
3. Selection and care of clothing.

Seventh Grade — Second Semester

1. Care and adjustment of plumbing.
2. Selection and serving of foods.
3. Care and use of finishing materials.

Eighth Grade — First Semester

1. Care and adjustment of electrical devices in the home.
2. Care and repair of metal articles in the home.
3. Selection and arrangement of home furnishings.

Eighth Grade — Second Semester

1. Selection and care of wood construction.
2. Care and adjustment of windows and doors.
3. Care of lawns and shrubs.

The instructional divisions of the home-mechanics course were determined by grouping the home maintenance and consumer needs which had enough similar characteristics to permit efficient instruction. For example, No. 2 for the second semester in Grade VIII, is based on the care and adjustment of windows and doors. The proper maintenance of windows and doors is very important in the efficiency, safety, and convenience of home life. Screens and storm sash must be changed with the seasons. Locks and hinges must be kept in good working order for efficient operation and to protect the home from theft. Windows must be properly cleaned for sanitation and light.

[2]Friese, John F., *Exploring the Manual Arts*, The Century Company, 1926.

Details of the Home-Mechanics Course

The home-mechanics course is given two 60-minute periods a week to boys and girls in the seventh and eighth grades. The instructional content of the course is stated in terms of home needs rather than in the conventional terms of materials and processes.

The giving of home mechanics to boys and girls may be new to some although there is good educational precedent for it, in fact, it has become a general practice in many schools. Opinions of educational leaders on the subject follow:

Professor Homer J. Smith[3] of the University of Minnesota states: "There is an accelerating trend toward the making of Industrial Arts a constant in school programs. Thousands of schools now require that all boys pursue some work in this curriculum area. A large and growing number of schools encourage girls to take this type of work, sometimes a few in boys' classes, often in special groups of their own and more often in evenly mixed classes as in algebra, history, and art."

Professor William H. Stone[4] of Ohio University writes:

"Traditionally, industrial arts education has been provided for boys only, now the trend is to conceive industrial arts not peculiarly as the beginning of trade education for men, but as *an avenue to a liberal and appreciative understanding of industrial life,* necessary for *boys and girls alike.*"

Professor Emanuel E. Ericson[5] of State Teachers College, Santa Barbara, Calif., comments:

"Not much has been done toward giving girls an opportunity to do routine home mechanics jobs. Just what is the apparent reluctance to let girls work in the shop is hard to determine fully, since it is certainly true that women now must attempt to work out problems of this sort."

Projects requiring pupil performance are given for each learning area. This consists of necessary jobs in the selection, care, repair, and construction of commodities used in and about the home. The

[3]Smith, Homer J., "Meeting Student Desires." *Industrial Education Magazine*, Vol. 24, pp. 105, 106. April, 1935.

[4]Stone, Wm. H., *Industrial Arts in Modern Education*, Manual Arts Press, Peoria, Ill., 1934, p. 139.

[5]Ericson, E. E., *Teaching Problems in Industrial Arts*, Manual Arts Press, Peoria, Ill., 1930, p. 176.

acquisition of practical knowledge and appreciation also form a major part of each unit of work; teacher preparation, visual aids, instruction sheets, and research are the means to this end.

A rather extensive suggestive list of projects accompanied with related information is given for each instructional area so that the teacher may select those most suitable for her particular school and community.

Objectives of the Home-Mechanics Units

A brief statement of the instruction objectives of each of the twelve divisions of the course are given in the following paragraphs:

The Reading and Making of Working Drawings: Ability to read drawings and make a simple work drawing is a valuable part of general education. The specific objectives of the drawing unit are: To acquire the ability to read drawings and blueprints made by others for use in construction projects; to make pictorial sketches for illustrative purposes; to make simple mechanical drawings of various kinds for self use; and to reproduce work drawings.

Care and Use of Hand Tools: The care and use of hand tools is integrated to some extent with all units of the course but this unit has the following specific aims: to learn the uses of common tools; to develop a handiness in the use of tools; to learn methods of care and repair of tools; to employ safety measures in the use of tools; and to consider economy and utility in the purchase of tools.

Selection and Care of Clothing: The specific objectives for the study of clothing by boys and girls are the following: to acquire practical knowledge of materials and styles used in clothing and accessories; to learn methods used in the repair of clothing; to learn methods and agents used in laundering; to take care of shoes; to construct simple items of clothing and accessories for personal use; and to appreciate the cost of personal belongings.

There are many possible learning activities in the clothing unit of the home-mechanics course. The following are suggestive: removing stains, cleaning and polishing leather, repairing rips and snags, sewing on buttons and fastenings, making shoe pocket or rack, belt, bracelet or fob, tie clip, purse or billfold, and work apron.

Care and Adjustment of Plumbing: A clear understanding of the care and use of the modern plumbing system is important to the health of every family. The purposes of the home-mechanics plumbing unit are: to understand the construction and operation of faucets, flush tanks, radiators, heating plants, and hose; to develop handiness in the care and minor repair of plumbing features in and about the home; to construct accessories for sink, bathroom, and hose; and to acquire practical knowledge for the care and purchase of plumbing parts and accessories.

Typical home-mechanics learning activities for the plumbing unit are: the care of sinks, bowls, tubs, drain traps, and radiators. The adjustment of faucets, flush tanks, and globe valves.

Selection and Serving of Food: The wise selection of food is important to everyone. Home mechanics has the following specific purposes in the study of foods for boys and girls: to acquire a knowledge of foods of value in marketing and in meal planning; to learn methods of food preparation; to engage in simple procedures used in the preparation of food; to acquire a practical knowledge of table equipment and kitchen aids; to learn methods and agents used in the care of kitchen and table equipment; to learn etiquette for table setting and service; to construct articles and devices which aid in the preparation, preservation, and serving of foods; and an appreciation of the cost of foods.

Methods and Practice in Painting and Finishing: The objectives of the finishing unit in home mechanics are as follows: to acquire knowledge of materials and methods used in finishing; to beautify and preserve the exteriors of buildings and construction about the home grounds; and to apply suitable finishes and decoration to articles constructed.

Typical learning experiences in the finishing unit are to prepare new surfaces for finishing; remove old finishes; cleaning brushes; applying paint, enamel, brushing lacquer, calcimine, and stain. Opportunity is also given for the use of decorative treatments with stencils, graining, antiquing, stippling, polychrome, and gesso. Special attention is given to cleaning and polishing furniture, woodwork, and floors.

Care and Adjustment of Electrical Appliances: Electricity is fundamental to the operation of many of the modern conveniences and luxuries in the home. The objectives of home mechanics are to give an understanding of the safe use of electricity in the home, to develop handiness in the care and adjustment of common electrical appliances, to construct simple electrical devices, and to develop discriminating judgment in the selection of appliances.

The electrical unit of the home-mechanics course includes learning experiences for boys and girls along the following lines. The underlying principles of the electric light, doorbell, electric iron, toaster, and radio. The prevention of shocks and short circuits. The replacement of a blown fuse. The repair of extension and heater cords. The cleaning and oiling of small electric motors used around the home. How to give first aid for electric shock.

Learning elementary electricity

Care and Adjustment of Metal Articles: The use of metals in home life is increasing. The home-mechanics course gives practical knowledge of metals used in the home, develops handiness in the care and adjustment of metal articles used in the home, and gives an opportunity to make simple, useful articles of metal for home use.

Typical home-mechanics jobs with metal are: cleaning and polishing metal objects, soldering and riveting household utensils, construction of cooky cutter, cooky pan, or hot-dish stand.

Selection, Arrangement, and Care of Home Furnishings: The selection and arrangement of home furnishings are problems that require constant study but home mechanics provides boys and girls an opportunity to acquire practical knowledge of materials, styles, and design used in home furnishings and accessories; to learn about materials and methods used in the care and repair of home furnishings; to use and to care for mechanical and labor-saving devices employed in the care of the home and its furnishings; to plan, select, and arrange furnishings with thought to economy, convenience, and beauty; and to

construct simple articles used for convenience or decoration in the home.

Selection and Care of Wood Construction: A knowledge of the care and uses of the wood construction in the home is still important although newer fireproof materials are being used frequently to replace wood construction. Home mechanics provides an opportunity to acquire useful information about commercial products made of lumber, to develop handiness in the care, repair, and refinishing of wood commodities in the home; and to make useful things of wood for the home.

Care and Adjustment of Doors and Windows: Doors and windows form an important part of every home. Their proper care and use is important to health and safety. Boys and girls have an opportunity in home mechanics to acquire practical knowledge of styles and materials used in the construction of doors, windows, screens, shades, curtains, and draperies; to understand the operation of locks and windows; to develop handiness in the care, repair, and adjustment of doors and windows and their accessories; and to construct simple articles and devices used in connection with doors and windows.

Typical learning experiences in the care and adjustment of doors and windows are: to wash glass, repair screens, glaze sashes, adjust and oil a lock, adjust doors and windows that squeak or stick, make a door stop, window wedge or window ventilator.

Care of Lawns and Shrubs: Lawns and shrubs add much to the beauty and enjoyment of home life. Home mechanics gives boys and girls an opportunity to acquire a knowledge of shrubs suitable for the home grounds; to learn methods of planting and caring for lawns, shrubs, and garden plants; to use, care for, and repair equipment and tools used in and about grounds; to repair and refinish constructions found about the home grounds; and to construct simple articles as aids in the care of lawns and plants and in the care of the home grounds.

Young experimenters

Methods of Teaching Home Mechanics

The home-mechanics course is taught one unit at a time allowing approximately six weeks for the development of each of the twelve units. The methods used in teaching are well-established techniques and center around teacher preparation, pupil-learning cycle, and evidences of accomplishment. The general method of developing a unit of the home-mechanics course is given in the following paragraphs:

The teacher must give consideration to the purposes, pupil interests and abilities, home needs, and workroom facilities in selecting the content for a unit of work. Care should also be given to the organization of subject matter and to class procedures.

Before introducing a subject to the class, the teacher must have on hand adequate instructional materials. These include: pictures, sketches, diagram, tables and charts, films and lantern slides, samples, objects, appliances and parts, and commercial material.

Information sheets are frequently used to supplement teacher directions and should contain descriptions of tools, materials, methods and principles, ideas for projects, hints, and suggestions.

Exploration of the pupil's background, interests, and home needs by means of class discussion or survey tests is a help to the teacher in selecting subject matter, grouping the pupils, and planning a guidance program. The teacher's presentation of the unit may be through a talk, an illustrated lecture, or a demonstration. A visiting lecturer or a class excursion are other methods of stimulating the interest of the class. After the subject has been presented, enthusiasm may be heightened and the information enlarged upon by means of illustrative materials posted on the bulletin board and at other places about the room. Mimeographed information sheets summarizing the date in the lecture also aid in this respect.

During the learning period the teacher contributes to the child's fund of knowledge by giving demonstrations in the construction, use, repair, and care of articles, appliances, materials, and tools. Talks illustrated with lantern slides, charts, diagrams, pictures, and objects, likewise aid learning. While the class is at work the teacher supervises in an unobtrusive manner all the operations that are taking place. He should "sense" troubles in routine and procedures, and remedy them as soon as possible.

The teacher should spend his time during the work period aiding and guiding the pupils. He should move among the groups offering suggestions for improvement of technique and method wherever needed. He should also aid those who are planning projects — designing and making working drawings. Those who are engaged in research problems also require supervision in locating information, clarifying statements, and recording results.

After proper introduction to the unit, the pupils begin the learning cycle. Here practical knowledge and manual dexterity are promoted by means of observation, performance, and research. Some exercises are engaged in by the class as a whole; others allow for choice according to varying interests and abilities.

Demonstrations and Visual Aids

Demonstrations and visual aids form the chief means of learning through observation. The demonstrations may be given to the class as a whole or to a group interested in a particular phase of work. Often a process or a principle can be clarified easier in this way than by reading or experimentation. The demonstrations are given largely by the teacher, though contributions may be made by experts from outside the school or from pupils possessing special information or skill.

Films and lantern slides may play an important part in developing a unit; they not only make lectures and discussions more interesting, but contribute substantially to knowledge of materials and industrial products. Other types of visual aids include objects, pictures, sketches, diagrams, charts, tables, working drawings, plans, and elevations. These, used in connection with demonstrations, lectures, and discussions or displayed in the workroom, do much to clarify and inform the class in regard to equipment, tools, materials, products, and methods.

Performance exercises are used to further handiness in the use of materials, tools, and devices, in the selection and arrangement of articles and parts, and in the repair, care, and construction of

objects, appliances and equipment. Some experiments in techniques and operation may be planned for use by the whole group. But in most of the jobs there should be opportunity for pupil choice. The job sheets provided for school projects should contain a sequence of problems of increasing difficulty; they should also include a group of different problems at each level, thus providing for the varied interests of individual members. In units such as those on plumbing, doors and windows, food, clothing, and furnishings, it is especially important to provide different sets of projects for the boys and for the girls.

Research activities contribute richly to practical knowledge, social understandings, and appreciations. These activities include reading, collecting illustrative materials, investigating home situations, consulting parents, workmen, and shopkeepers, and visiting shops and stores. Reading assignments may consist of the books in the room and public libraries, reference books, magazine and newspaper items, government pamphlets, and commercial publications. Collecting illustrative materials includes the gathering of pictures, sketches, diagrams, charts, tables, working drawings, samples of materials, and objects themselves. Investigating home conditions involves inspection of commodities in and about the house to ascertain their material, style, practicability, beauty, principles of operation, and opportunities for improvement through care, repair, and rearrangement.

There are several means by which the teacher, and the pupil himself, may check upon accomplishment during the progress and at the completion of a unit of work; namely, finished jobs, reports, and achievement tests.

From time to time pupils may be called upon to make short oral reports and to enter into class discussions. Written reports may also be called for. These reports may deal with manual exercises or research. They make a valuable contribution to knowledge and appreciation.

The values of achievement tests in *Home Mechanics* are the same as those for achievement tests in general: (1) to provide a less subjective method of grading pupils; (2) to formulate standards of achievement; (3) to establish a basis for subject matter, teaching methods, organization, and grade level.

The Home-Mechanics Room

Figure I, shows a home-mechanics room layout. The central part of the room is equipped with eight worktables and two benches with woodworking vises. Six stools are provided at each worktable. When the learning activities take the form of discussion, demonstration or visual instruction the pupils sit on the stools. When they wish to work at the table they can push the stools under the tables out of the way and stand or some can sit and some stand at the table depending on the type of work. The table tops are of birch or maple finished natural so they are not easily scratched and can be used for a variety of work. The walls of the room provide space for wall bench, cases for storage of tools, supplies and pupil projects, a sink, sewing machine, ironing board, bulletin boards, and blackboard. The room layout is quite flexible and can be used for either academic or construction work.

Tools

The home-mechanics course does not require the use of any power-driven machines. The only machines in the home-mechanics room are a hand grinder and a foot-power sewing machine. The most common hand tools used in the home-mechanics room are hammer, screw driver, coping saw, crosscut saw, file, plane, ruler, knife, chisel, brace and bit, hand drill, pliers, wrench, scissors, oil stove, glass cutters, tin snips, mallet, clamps, soldering iron, scraper, putty knife, trowel, electric plate, machinist vise, and awl.

The home-mechanics room is not expensive to equip. The cost runs from $500 to $800 depending on the size of the room and the number of pupils that are to be included in the classes. A good class size is from 30 to 40 pupils.

The Home-Mechanics Teacher

The home-mechanics teacher may be either a man or woman. He or she should have the general educational and professional background that is considered fundamental in the preparation of all elementary teachers. In addition the home-mechanics teacher should have mechanical ability and have specialized training in the teaching content and methods of teaching home mechanics.

The Chicago home-mechanics course has been developed to fill a modern educational need which is the result of fundamental changes in our industrial, economic, and social life. It is a course that is flexible and will continue to grow and make necessary additions and deletions from its content whenever new and better ways of living are introduced into modern home life.

The home-mechanics course contains a great deal of information relating to the home and its maintenance but it is not an academic course. The majority of the pupil's time is spent in learning procedures which involve the manipulation of tools and materials.

Co-operative Vocational Education

R. E. C. McDougall

Superintendent of Schools,
Orrville, Ohio

A description of the organization of co-operative education at Orrville, Ohio.

Progressive vocational education ever ministers to the needs of the individual student. With this thought in mind the Orrville board of education has authorized the organization of a co-operative vocational school, to be operated in conjunction with the local industries of the community. The philosophy which suggests such a policy is based upon the belief that the public schools must offer to a larger portion of its youth, opportunities for preparation in the skilled industries.

Under this co-operative plan, which is endorsed and approved by the Ohio State Department of Vocational Education, the student, upon graduation, will have had one or more full years of training in some local industry. Through his industrial experiences, he will acquire valuable work habits and practices, which the ordinary school training does not produce. This type of training will help those students who are not interested in the purely academic courses, and who would likely drop out the first or second year, because the curriculum is not more suited to their particular requirements. At present industry is in serious need of skilled and semiskilled labor. With the schools working hand in hand with the local industries this condition may be changed to the advantage of the local community and the establishment of the high-school youth in positions of stability and income-producing possibilities. This new type of instruction will also benefit the large number of students who do not plan to continue their educational work beyond the high-school level.

Control of the School

The co-operative school operates in connection with the regular school system. The board of education is responsible for its operation and supervision. An advisory committee composed of the superintendent of schools, the high-school principal, and the local co-ordinator will co-operate with plant executives to put the plan in operation.

To a great extent, both the local authorities and the state department of vocational education, realize that the success of this type of organization depends upon the vision philosophy and initiative of the co-ordinator. This is the title of the

teacher of this type of school. The co-ordinator is employed by the board of education, as any other teacher in the system, and subject to the same supervision and regulations. He is employed on the yearly basis and allowed two weeks' vacation with pay. The salary of the co-ordinator is paid by the board of education. By agreement, however, with the state board of vocational education, the Orrville board is to be reimbursed for the instructional costs and supervision in accordance with an existing schedule of state aid.

The duties of the co-ordinator are manifold and exacting. His public relations with local executives will require a high degree of intelligence and skill.

The duties will include the teaching of related subjects which will be outlined in accordance with the state requirements. All classroom instruction is carried on in the high school. The co-ordinator will be especially certificated by the state department of education. His further duties require him to avail himself of every opportunity to extend his professional qualifications through professional extension courses and by actual contact during certain specified periods, with the working conditions and methods utilized in the best type of industrial plants. All time that is not devoted to classroom instruction will be devoted to the proper co-ordination between the school and industry.

The necessary facilities and equipment necessary for the operation of this type of school will be supplied by the local board of education. The industries co-operating will likewise make available such equipment, tools, and machines as may be deemed necessary for the work to be carried out in the plants.

Personnel of the Co-operative School

Any boy student who is sixteen years of age, and who has completed the tenth grade may be eligible to enter the co-operative school. He shall also have completed the industrial-arts work, including machine practice, in the ninth and tenth grades. In addition, a guidance program will have determined the student's personal qualifications, aptitudes, and interests. The course is not intended for the slow, retarded, or unduly handicapped child. To consider any other than the highly gifted mechanically minded type for this type of educational effort would be unfair to the plan and to those engaged in its operation.

The co-ordinator will confer with the students, and with other teachers in the system as to the personal qualities of the students who desire this type of personal training. Approval of the parents of the students will be obtained, and each boy will sign a contract to add dignity and import to the whole transaction. Every inducement and motivation will be provided not only to engage in the course but to put forth every effort to complete the task. Two years of prevocational training is requisite for this new type of instruction.

The prevocational group will consist of boys in the ninth and tenth grades who may elect to take the co-operative course during their last two years in high school. As all other students they are expected to earn four credits a school year, including credits in industrial-arts and general-shop work.

A careful check will be maintained at all times with the items of supply and demand in mind. The placement of trained workers will be an inspiring and worthy part of this program. The number of students assigned to any one industry or local activity will be a matter of impartial and careful selection.

Organization and Operation

Students in the co-operative school spend part of the time at school in the study of related subjects, and the same length of time in a selected industry. The subjects taught are related directly to the needs of the student in the industry in which he is located. They include such subjects as shop mathematics, practical English, mechanical drawing, reading of blueprints, shop safety, and drafting. During the alternate weeks when the student is out in the local industrial plant, he is not there for the sole purpose of working, but rather for instruction in his particular choice of occupation. Every effort will be made to eliminate any thought of commercializing on the work of the student assistants. The amount of work completed should not be of such quality and quantity that there be any thought by either the student or private workmen, that exploitation is taking place or that any jobs of workers will be taken away from them. The employer of any industry will be asked to designate members of his regular staff to act as instructors of specific tasks and machine practice.

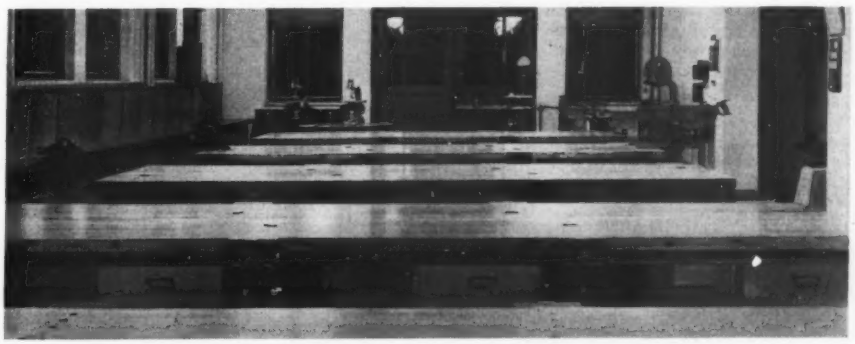
The length of the co-operative school year is 48 weeks. Students are two weeks in industry and two weeks in the classroom. This term applies only to the students in the eleventh and twelfth grades. At the end of the twelfth year, the student having completed the two-year prevocational course, and the two-year co-operative course will receive a vocational-high-school diploma. The credits so earned may not permit him to enter college without an examination. Under the school code, sixteen-year-old boys may work in industry under the co-operative plan. The superintendent of schools is authorized to issue the necessary certificate.

After the student has attained a certain degree of efficiency in his selected trade, a uniform rate of payment becomes operative. This rate is adjusted by the advisory committee of the school system in co-operation with the local executives of the industrial plants. This part of the plan has been suggested by local executives who have been contacted as to their willingness to co-operate in the project. They believed that it would make for harmony, good will, and tend to act as a motivating agent to all concerned. Regular members of the co-operating industries will act in the place of instructors in connection with the regular co-ordinator.

Students enrolled in the co-operative department will be encouraged to participate in all of the regular activities of the school program. They will be urged and provision made for their participation in athletics, band, orchestra, and the many club groups, in which their interests may lie. These students will be enrolled in the physical-education classes, requiring 90 minutes a week. Time missed due to the industrial schedule may be made up in regular sessions.

Local Interest in the Program

Contacts made by the local school officials with the industrial leaders of the community have been a source of pleasure and gratifying in the extreme. Individuals have given of their time and have been most generous in making suggestions for the success of the plan. During the survey, members of the chamber of Commerce and individual businessmen pledged their activity and support. Executives of the local printing plants, auto-body building establishments, foundries, automotive industries, and woodworking factories have expressed a decided willingness to participate in the new type of school training, thereby making possible this venture in co-operative education.



Woodworking and general-mechanics shop, Backus Junior High School, International Falls, Minn. Submitted by Wayne M. Judy and Oscar Sontag.

Teacher's Self-Rating Scale

J. W. Giachino

High School,
Hamtramck, Michigan

In all walks of life, people are judged by their fellow men according to their efficiency in rendering society that service for which they have been trained. In each instance, they are invariably cataloged as good, average, or poor.

Teachers, naturally, are no exception, and their rating carries even more importance since theirs is the responsibility of training boys and girls to become useful American citizens. It is only logical to expect those who are directly obligated in influencing the future destinies of children to be individuals possessing the greatest degree of skill. Consequently, this function of teacher appraisal must be taken very seriously if the teaching profession is to have in its ranks people of the highest caliber.

To be judged by others as to one's ability must be taken as a matter of course but of paramount importance is the success with which an individual is capable, periodically, to take inventory of himself. When a teacher assumes the initiative to rate his own efficiency in discharging his services, he can take immediate steps to eradicate those faults that may be keeping him in an undesirable class. Self-analysis is important but only to the extent that an individual will conscientiously recognize his weaknesses and strive to apply the proper remedies for their correction.

The development of a plan possibly similar to the one given here may help a teacher interrogate himself concerning the degree of perfection he has attained in discharging his duties as a teacher. Perhaps the ability to answer satisfactorily these few questions may not be entirely indicative as to his rank in the teaching profession; still it may serve as a guide to correct or improve certain techniques which may have been ignored, possibly through carelessness or unawareness.

Directions: Read each question carefully, and after thoughtful deliberation, indicate in one of the columns the degree each fact represents your true self. Each question carries a value of 0 to 5 points, the 0 to indicate negative possession of the quality mentioned, and 5 to represent the highest attainment of the attribute specified. Upon completing the test, total your score. The following values will give an approximate picture of your personal rating as a teacher:

145–160	Good
130–145	Average
Less than 130	Poor

Teacher's Self-Rating Scale

	0	1	2	3	4	5
1. Do you make it a practice to stimulate your students whenever the occasion demands it?						
2. Do you encourage your students to plan their work and think through their problems?						
3. Do you encourage your students to develop good habits of work?						
4. Do you incorporate in your teaching the democratic principle of co-operation?						
5. Do you teach subject matter or students?						
6. Do you attempt to make your subject matter as interesting as possible for your students?						
7. Do you keep in mind that no two students are mentally alike and consequently individual capacities must be considered in your teaching?						
8. Do you make an attempt to fully understand your students, to discover their failings, their abilities, their interests?						
9. Do you find it pleasant to work with school children?						
10. Do you seldom lose your patience when you cannot get your point across to some students?						
11. Do you strive to convey your teaching to the level of a child's ability?						
12. Do you keep sight of the fact that boys and girls are immature and may therefore be unable to grasp readily what you are attempting to put across?						
13. Are you successful in controlling your temper when confronted by some irritating problem?						
14. Are you able to solve disciplinary problems without having to resort to corporal punishment?						
15. Do you refrain from doing most of your teaching sitting at a desk?						
16. During the work period do you mingle with the students, helping them with their work?						
17. Do you willingly remain after school hours to accommodate pupil needs?						
18. Do you read current magazines, books, etc., dealing with your particular field of teaching?						
19. Do you take good care of your equipment?						
20. Do you have a well-organized system for handling tools and supplies?						
21. Do you encourage your students to use supplies as economically as possible?						
22. Do you teach safety measures to your students?						
23. Do you offer any counsel and guidance to your students?						
24. Do you occasionally revise your course of study to keep up with modern trends?						
25. Do you make an attempt to correlate your subject with the other courses in your school?						
26. Do you accept suggestions and give them a tryout in the proper spirit?						
27. Do you make it a practice to report to work on time?						
28. Do you refrain from completely forgetting your schoolwork as soon as you leave the classroom door at the end of the day?						
29. Do you have and follow a well-organized course of study?						
30. Are you punctual in sending reports, records, etc., to the office?						
31. Are you in the habit of making out all reports, records, etc., with exacting care, free from errors and legibly written?						
32. Do you seldom forget to make necessary announcements to your students after being instructed by the office to do so?						
33. Do you allow personal likes and dislikes to influence you in grading a student's work?						
34. Do you frequently subject students to written examinations and then discard their papers without appraising them?						
35. Do you encourage your students to appraise their work and analyze their own faults?						
36. Do you incorporate in your teaching, attitudes of good character such as honesty, dependability, etc.?						

The Modern Trend in Automotive Service

R. K. Schieb

Hower Vocational High School, Akron, Ohio

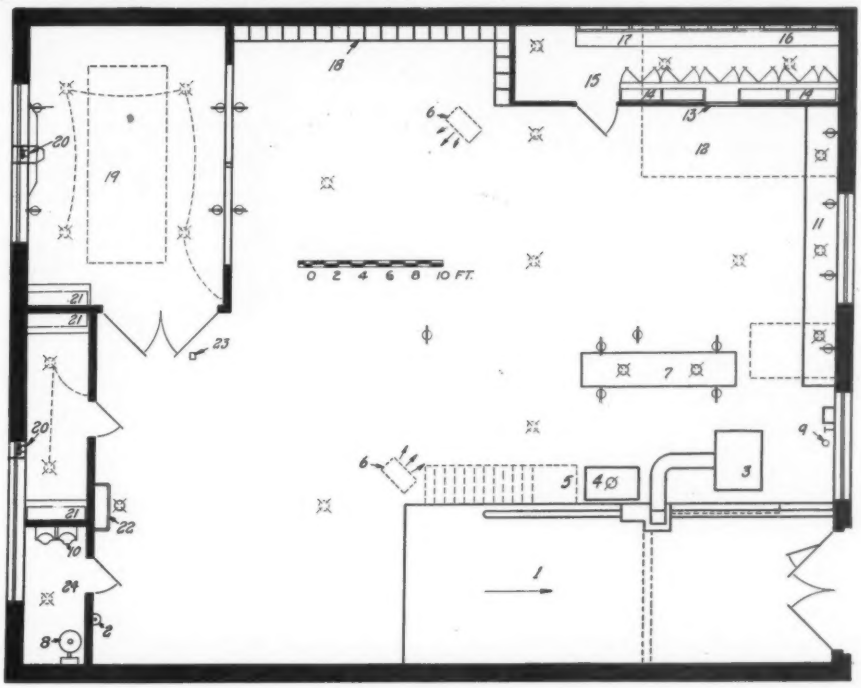
A phase of auto repairing that demands more and more attention.

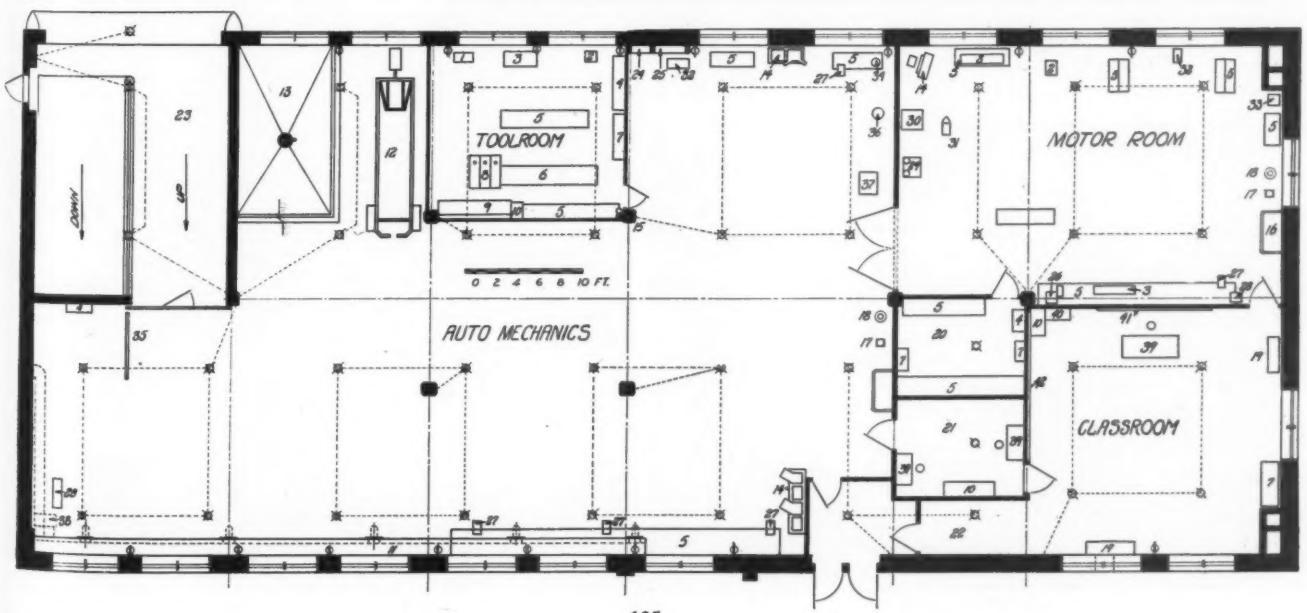
During the past few years, the auto-body rebuilding and refinishing trade has come into its own. The events contributing to the setting apart of this trade from the old auto-mechanics shop have been evolutionary with the development of the automotive industry. In the early days of automotive industry, the manufacturers' interests dealt primarily with mechanical perfection. Design was unthought of. During the past ten years, automobile manufacturers have spent considerable time and money setting up research laboratories, the main function of which was to determine the psychological viewpoint of the buying public.

These research laboratories set out on a definite purpose to produce a car combining mechanical perfection with beauty, comfort, and ease of operation. To do this it was necessary to depart radically from the old straight-line box-affair design and to produce an artist's creation which would develop pride of ownership on the part of the customer. This meant the introduction of aerodynamic streamlined body designs with chrome trim and luxurious interiors, also the development of iridescent and other quick-drying paint finishes. All of these added greatly to the complex problems of the auto-repair industry. A scratched fender, a body dent, a complete wreck, and the restoring of the car to its original form have demanded a higher type of skill and workmanship than has ever before been known to the industry.

There is a shortage today of skilled workers in this field. All over the United States apprenticeship programs have been started. Public and private schools have excellently equipped laboratories for the training of youth. It will take years to adequately train the number of skilled workers necessary in this field.

The car of today is so mechanically perfect in endurance, and so automatically foolproof in operation, that little or no *mechanical attention* is necessary for several years after the original purchase. On the other hand, the *beauty maintenance*





A corner of the body-repair department displaying the installation of a new turret-top assembly

Student working with air-hammer straightener at left; electric hot-metal spray gun at right

service, including fender and body work and painting, is becoming more in demand from the very first day of original purchase. This trade, no doubt, will greatly expand and stabilize the entire automotive-service field.

Most service shops throughout the country have already realized this situation through actual experiences and are now striving to bolster up their service *cash receipts* through the addition of auto-body rebuilding and refinishing work, but they have encountered great difficulty in locating workmen who are capable of handling this specialized type of work as artistically as the trade demands it. The workmen in this type of service must be as artistic as the original craftsmen in order to restore to the car the original beauty in appearance after accidents, to refinish properly after the original paint has deteriorated through use, and to maintain the original attractiveness throughout the entire life of the car.

The Hower Vocational High School in Akron, Ohio, has been developing a course in this type of specialized work for more than three years and has definitely established it as an inseparable part of the automotive-service training program.

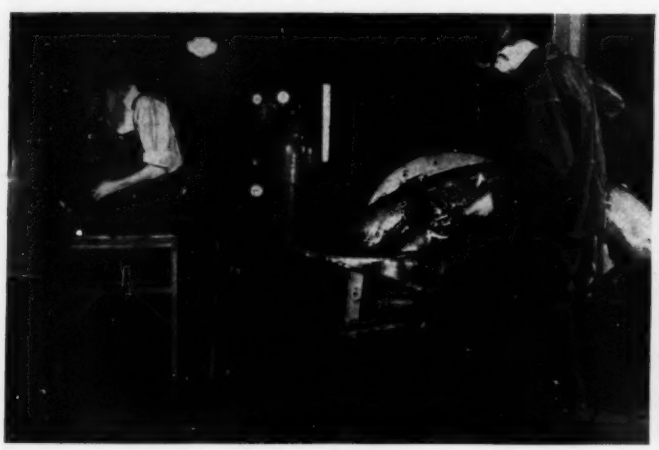
The specialized work of auto-body rebuilding and refinishing as practiced today, is a combination of the four former independent trades of auto sheet-metal repairing, upholstering and trim work, welding and blacksmithing, and automobile paint refinishing. This combination of work has always been considered too intricate to teach in the high-school vocational bracket prior to the present development of modern equipment, methods, and materials. But now, with spray painting of lacquers and quick-drying enamels, air-hammer straightening tools, paint color-mixing devices, removable unit upholstering assemblies, and many other modern improvements in equipment and materials, the trade has become comparatively easy.

The new development in artistic automobile design and beauty has created an unusual demand for extension training of those already in the trade, and for initial training of new men to fill the present and future demands of thousands of shops that did not do this type of service heretofore.

It requires three or four years to train men properly for this highly skilled occupation, and because very few men have been trained in any phase of the work during the past eight or nine years, it seems imperative that the training programs get under way immediately.

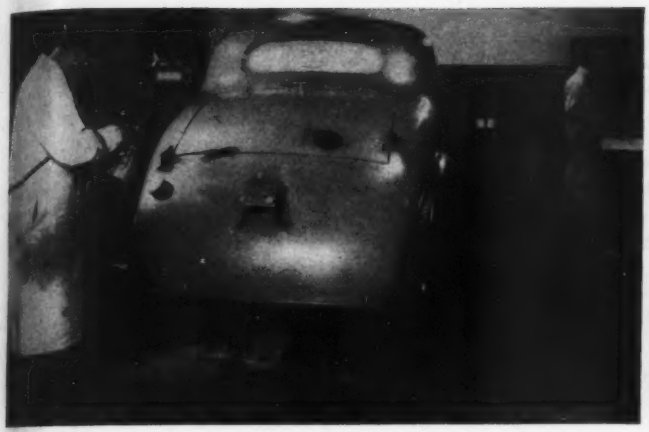
The adult training in the Akron program is carried on in evening-school classes, in which the instructional work is confined strictly to shop operations with no academic work. The day-school training program, being within the high-school vocational brackets, devotes one half of the time to the related subjects of mathematics, science, drawing, industrial history, civics, and English. The other half of the training is devoted to shopwork. The entire shop-training program is based upon a step-by-step progress chart system covering all of the minor and major details of the trade.

The first two semesters are occupied with mastering the principles of the trade by lecture, demonstration, and benchwork. Special fender and door practice benches have been built by the students to hold removed parts firmly during the practice periods. The fenders, doors, and other pieces used in the preliminary practice work are discarded parts supplied by the service shops at no cost to the school.



The welding department. Students at work with oxyacetylene and welding equipment

Doors and fenders, removed from cars, are attached to special benches for parts repairwork



Preparing a car for complete refinish in synthetic enamel

Paint mixing with precision instruments at left; color matching and blending with the electric color eye at right

After the first two semesters of initial training on shop theory and benchwork, the remainder of shop training is devoted to actual types of work on cars that the student may encounter in the trade. Cars with the proper sorts of work to be done are selected carefully in order to cover actual repair operations as designated on the progress charts. This type of repair-work is done in exactly the same manner, and with exactly the same kind of equipment as that used in the service shops. Every job must be a perfect and an exacting piece of workmanship.

During the final period of training much stress is laid on the use of improved equipment, special operations, color matching, job estimating, and the like. Some of the more recent developments in the trade include modern paint spray equipment, hot-metal spray guns, air hammers, power body jacks with special attachments, striping machines, polishing machines, paint-mixing and tinting equipment such as the electric color eye, and many new types of special tools to handle reconditioning of the new body shapes and designs. In addition to the lacquer-paint materials, recent developments in paint are quick-drying synthetic enamels and combination lacquer-enamel products, all of which require special application processes. Iridescent metallic paint finishes require a different method of application than straight colors, and so on.

In conclusion, may it be emphasized that the auto-rebuilding and refinishing trade covers a wide range of operations that are peculiarly characteristic to this trade alone and that cannot be taught in their entirety in conjunction with any other trade. It may be possible, however, to incorporate some of the easier details in an auto-mechanics course, such as minor fender repairs and minor paint touch-up work.

The following is a general brief outline

The wreck

The wreck revamped

The auto-finishing department. Overhauling door mechanism at left; block sanding in the center. At right, car ready for complete lacquer refinish in white

General reconditioning of old paint finish, including spot spray touch-up before waxing and polishing

being followed in the auto-body-rebuilding and refinishing course of training. Each of these units, however, is broken down into many independent jobs, which in turn are divided into nearly five hundred detailed operations, in actual shop application:

1. Trade theory.
2. Auto body construction.
3. Auto hardware and mechanisms.
4. Trim and upholstering.
5. Metallurgy.
6. Oxyacetylene torch work.
7. Auto sheet-metal replacement parts.
8. Auto sheet-metal repairing.
9. Body repair operations.
10. Frame straightening and blacksmith work.
11. Squeaks, rattles, and leaks.
12. Painting equipment.
13. Paint materials.
14. Painting processes.
15. Color theory.
16. Paint mixing and color matching.
17. Paint applications.
18. Reconditioning old paint finishes.
19. Auto glass work.
20. Bumper and chrome-plate repairing.
21. Miscellaneous operations.
22. Shop equipment and maintenance.
23. Shop clerical training.
24. Job estimating.
25. Reference study.

Equipment

Air compressor unit (10 to 20 cu. ft. capacity piped through shop)
Air cleaner and regulator
Anvil
Axle stands
Benches for general work, fender practice, door practice, paint color mixing
Bending bar, heavy-duty, adjustable
Blackboard, small for lectures
Bookcase
Bulletin board
Cabinets, first-aid, tools and supplies, special equipment
Chairs, folding (for shop lecture and demonstration)
Creepers
Desk, instructor's
Drills, hand, electric, ½-in. portable
Fire extinguishers
Grinders, stationary bench type, portable (combination disk and wheel)
Jacks, body-repair (hand and power, fender repair, regular 1½-ton, floor-roller type)
Lapboards (for taking notes during lecture and demonstration)
Spray guns, for automobile paint work
Vacuum cleaner for auto upholstery
Ventilator fans, for paint spray work
Waste cans
Water hose
Welding equipment, gauges, regulators, welding torch (sheet-metal type), cutting torch (for light work), tongs, welding table, portable welding truck

Hand Tools

Air-dust nozzle
Awls
Bars, crowbar, light bending bar, jimmy bar
Battery carrier strap
Bits, auger 3/16 to 1 in. by 8ths
Bit brace, 10-in. sweep, ratchet
Blowtorch
Bolt and screw extractors
Brooms
Brushes (hand), wire, bristle
Buckets for sanding
Chisels, wood, cold
Clamps, bar 24-, 48-, and 72-in.; C 4-, 6-, and 8-in.
Color-mixing set
Dividers
Dollies, bar, beading, clam-shell, fender flange, fender well, heel, palm, roughing-out, spoon-dolly, universal, specials
Door-handle tool set
Door-pin remover
Files (with handles), metal-worker's: Flat sheet-metal finish, half circle, fender well, shell, riffle, molding, special
Files, regular shop type: Flat bastard 10-in., mill-smooth 10-in., round bastard 10-in., square bastard 10-in., half-round bastard 10-in.
Goggles, welding, plain glass
Hammers, ball-peen, bumping 9-oz. and 14-oz., claw, cross-peen, ding 10-oz. and 13-oz., flanging, angle head, point finishing, raising, rubber mallet, sledge, tinner's riveting (square head), upholstering, wood mallet, soft metal head or rawhide
Headlight-adjusting chart
Headlining tool
Hinge straightening tool
Lamps, extension cord, 25-ft.
Oil cans, ¼-pt. spout, 1-pt. plunger (penetrating oil)
Paint brushes
Panel cutter
Pick tool
Pliers, combination 6-in., drip molding
Punches, center; hollow ¼-, 5/16- and ⅜-in.; pin ⅛-, 3/16-, ¼- and 5/16-in.
Putty knives, stiff 1½-in., flexible 3-in.
Respirators
Rulers
Sanding blocks
Saws, hack, crosscut
Scrapers for scraping rust
Screw drivers, standard 4-, 6-, 8-, and 10-in., Phillip's head 6-, 8-, and 10-in.
Shears, upholsterer's, tin
Soldering coppers, 3-lb. chisel point with handles
Spoons, turret top long and short, fender bracket, flat, curved, molding, forming, & wheelhouse
Striping machine
Striping brushes
Squares, try-miter, T bevel
Tap and die set, garage type
Twist drills (set with block), 1/16- to ½-in.
Wheel-aligning gauge
Wrenches, open-end ¼- to ⅞-in.; socket ¼- to ⅞-in.; pipe 8- and 12-in.; crescent adjustable 6-, 8-, and 10-in.; wheel-removal wrench

Supplies

Bolts, cap screws, SAE (fine thread) ¼ by ¾ in., 5/16 by 1 in., ⅜ by 1¼ in.; STD (coarse thread) ¼ by ¾ in., 5/16 by 1 in., ⅜ by 1¼ in.; carriage, 3/16 by ¾ in., ¼ by 1 in., 5/16 by 1¼ in.; nuts, SAE (fine thread) ¼, 5/16, and ⅜ in.; STD (coarse thread) ¼, 5/16, and ⅜ in.
Cotter pins, assorted sizes
Nails, No. 19 brads ½ in. long, common 2d and 8d, Parker-Kalon assorted.
Paint supplies, abrasives, 100 and 150 production paper; 220, 280, 320, 400 Speed Wet paper; 36, 40, 50 sanding disks; rubbing compound. Beef cloth for polishing. Cements, top sealer, weather strip. Chamois skin. Chassis paint. Cleaners, fabric, body polish and cleaner, naphtha, refinisher's solvent cleaner (wax remover). Colors, lacquer assorted tinting colors, enamel assorted tinting colors, striping (assorted colors). Masking tape and masking compound. Putty glaze. Rags and wiping cloths. Sealers. Sponges. Thinners, lacquer thinner, lacquer retarder, enamel thinner, turpentine. Top dressings, black, clear. Touch-up enamel (black). Undercoats (lacquer and enamel), primer, surfacer, combination primer surfacer
Solder, acid core, body solder, 70-30 (meter-bar size), mutton tallow for solder paddling, paddles and blocks for solder paddling, soldering flux, solid wire solder, aluminum solder
Scrap metals for welding practice
Screws, flathead, bright wood screws, No. 4 by ½ in., 6 by ¾ in., 8 by 1 in., 10 by 1¼ in., 10 by 1½ in., 12 by 1½ in., 12 by 2 in., 14 by 1½ in., 14 by 2 in., 14 by 2½ in.; assorted Parker-Kalon metal screws (assorted set)
Tacks (trimmer's enameled), 4-oz., 6-oz., 8-oz.
Washers, lockwashers 3/16-, ¼-, 5/16-, ⅜-, and ½-in.; wrought iron 3/16-, ¼-, 5/16-, ⅜-, and ½-in.
Welding supplies, asbestos, flake, sheet; firebrick (for welding table; fluxes, aluminum, bronze, cast iron, alloy steels; gas, acetylene and oxygen; rods, aluminum, alloy, bronze, cast iron, low carbon steel
Wire, soft iron wire for weld reinforcing on fender edges, etc.

NOTE: After the shop routine is in operation, the jobs upon which work is done should pay a nominal fee for making the material and supply account self-sustaining.

This 12-in. by 4-ft. Type M geared head lathe, motor driven, was donated by the Sebastian Lathe Company employees shown in the photograph. This lathe is now at Boys Town, Nebraska. — The Howell Electric Co., Howell, Mich., donated the motor, and two chucks were donated by the D. E. Whiton Machine Co., New London, Conn. — This is the first piece of metaworking equipment which Boys Town has.

Practical Arts for the Junior High Schools

Jay H. Wood
M. L. Mullins
George Rogers Clark High School, Hammond, Indiana

A study that might well be imitated elsewhere.

In the spring of 1938, two teachers of practical arts in the Hammond city schools, Hammond, Ind., who were taking graduate work in Indiana University, made a study of the practical-arts program in the junior high schools of the Calumet area. They had the co-operation of the Indiana University Extension Division and the school administrators of the Calumet area. Recommendations emerging from this study are to serve as guiding principles in adjusting the practical-arts program in the schools of the Calumet area, as nearly as possible, to the aims of the junior high school as seen by authorities on the subject.

The cities in the Calumet area are Hammond, Gary, East Chicago, Whiting, and Calumet City. A survey was made of practical arts in the schools of these cities to discover the present conditions in this field and determine the physical possibilities of the school shops which are carrying on this work. This was done by personal interviews with school superintendents, industrial-arts supervisors, and shop teachers, and by visiting the individual school shops.

From this survey it would seem that the general plan used in the junior high schools of the Calumet area facilitates the use of the unit shop with the following activities predominating: Woodwork, drawing, metalwork, electricity, and printing. In general, the time allotment is one 55-minute period per day, five days per week, in the seventh and eighth grades. Some of the schools offer ten periods per week in the ninth grade. The size of classes varies from 15 to 30 in the various schools. It has also been found that instructional sheets and informational sheets are being used in most cases. In practically all of the schools a fee of 25 cents a semester is charged for the shop courses. The emphasis on woodwork predominates, but at present the tendency is to give increased attention to metalwork.

In addition to the survey, a comparison was made with courses of study now in use for practical arts in the junior high schools of cities comparable to those of the Calumet area. The outlines of study prepared in several states, were also examined. A list of 27 periodical references and nine books by competent authors were studied for information on the following phases of the subject: objectives, offerings in the various schools, unit shops versus general shops, time allotments, methods of rotating classes, industrial arts for girls, home economics for boys, wide variety of activities versus a well-selected few, and methods of integrating practical arts with the other subjects of the junior high school.

From these sources the writers built a program in practical arts for the junior high school which could be used in the Calumet area.

Objectives

For a matter of convenience, the reader is offered a list of four major aims of the junior high school, as stated by Dr. Foster, Professor of Education at Indiana University.

An appropriate expansion of these four aims includes all of the important statements suggested by the authorities. The four aims are: (1) Exploration, (2) Guidance, (3) Reenforcement, and (4) Enrichment.

Exploration includes all possible experiences from which a pupil may discover facts concerning not only the world about him but about his own interests, desires, aptitudes, talents, possibilities, and capabilities. *Guidance* includes the co-operative efforts of the pupil and his school toward the proper selection of school activities, hobbies, recreational activities, the educational pursuit of the future, and possibly the vocational pursuit. *Re-enforcement* is the name given to the performance under new conditions of habits and skills that the pupil had previously acquired, with the purpose of re-enforcing their functioning. Re-enforcement also includes the acquiring of new skills, habits, attitudes, and appreciations — in other words, it is not sufficient to rehearse the learning of the elementary school, but it should be rendered functional and extended. *Enrichment* includes many of the features lacking in the elementary grades. More attention to individualized instruction allows a nearer complete adjustment to individual differences. The junior high school purports to make it possible for a pupil to spread out in any direction in a subject field, take in what he wishes, and go at his own rate. Greater happiness is assured for both the dull and the bright.

Now for the question, "How do practical-arts activities contribute to the aims of the junior high school?"

Exploration. By allowing the pupil to experience a wide range of activities, he may be given a valid basis for discovery of his special aptitudes, likes, dislikes, etc., in the practical activities of life.

Guidance. What better guidance data would an administrator or counselor desire than a cumulative record of a pupil's achievement, aptitudes, and interests along practical lines? This would be a vital link in the evidence that should guide toward a future educational or occupational program.

Re-enforcement. The test for academic learning, especially of the "tool subjects," comes in the ability to apply it to practical situations. Practice in the application of information to real situations results in power. In this field the practical arts make a fine contribution.

Enrichment. Many activities of the junior high school by their very nature branch out into the construction of objects. The lack of the opportunity to do this kills interest. The practical-arts subjects welcome the opportunity to complete an idea that was born in science, or mathematics, or any other subject; in fact, the practical-arts program has committed itself to a conscious effort toward correlation.

Thus it is seen that the practical arts make their unique and vital contribution to the aims of the junior high school.

Recommendations

In making the recommendations for the proposed activities in the junior high schools of the Calumet area, it will be necessary to keep several points in mind. Since the survey shows that in the different schools there are found both unit shops and general shops it will be necessary to make recommendations for each setup. It will also be necessary to keep in mind the equipment, tools, and size of the shops that are found at the present time. It is admitted, therefore, that each administrator will have to make the best adjustments that circumstances permit.

One of the recommendations that is vital in the industrial-arts program is the time allotment. At present it would seem that most of the schools are operating on the 55-minute period, five days per week. This is the most common plan found in the junior high schools of the United States. Therefore, it is recommended that all schools in the Calumet area continue on this same basis. The A. V. A. report substantiates this plan also. More and more schools are operating on an even longer (the "extended") period.

Grade	*Activity*	*Semester*
7B	Planning and blueprint reading	one
7A	Woodwork	one half
	Electricity	one half
8B	Metalwork	one half
	Printing	one half
8A	Boys: Foods and textiles	one
	Girls: Home mechanics	one
9B	Boys and girls: Choice of any of first five activities	one
9A	Same as 9B	one

Table 1. Proposed practical-arts program for the junior high schools of the Calumet area. This program, as outlined, best fits the unit-shop arrangement, but with minor changes it is easily adaptable to the general-shop plan.

It is recommended that the instructor of the general shop make every effort to present planning and blueprint reading to all 7B boys at the same time. The 7A and 8B boys would then be rotated in the remaining four activities as necessity dictates. The time allotment for all grades is five 55-minute periods per week.

In the ninth grade it is recommended that one 55-minute period per day, five days per week, be allotted for the practical arts instead of the usual double period which is prevalent in the Calumet area. It has been found that although the double period gives more time for production of quantity the single period fits into the daily schedule of classes much better and will eventually bring practical arts up to the same plane with the other subjects offered in the junior high school and at the same time offer shop opportunities to more boys.

The selection of activities recommended is not arbitrary with the writers. An effort has consciously been made to reduce the suggested list to activities which best represent the major phases of industrial life. Reports of studies made by Roberts,[1] Fales,[2] Simon,[3] and the offerings of a vast number of cities comparable to those of the Calumet area list drawing, woodwork, electricity, metalwork, and printing as the most representative. Coincidentally it is found that the above-named subjects rank high in interest among industrial-arts subjects. Rowley,[4] from a study of 72 junior high schools from all parts of the United States found this exact selection the most popular.

The content and nature of the proposed 7B course of planning and blueprint reading will necessarily differ from the course of this nature that is optional for 9B and 9A boys and girls. The well-established methods and content of so-called mechanical drawing will serve as the basis for the 9B and 9A course. To those who may doubt the efficacy of offering a semester of planning and blueprint reading to 7B boys is given the assurance that this course has no tradition. In such a course may well be included the reading and constructing of drawings and plans for woodwork, metalwork, electricity, and printing projects, the methods of specifying materials, the planning of procedures, the reading of interesting related information, and the elements of orthographic projection and perspective drawing. Such a course would prepare boys to enter shop activities with better selected interests, more deliberate plans of action, and a better understanding of the problems they will encounter.

Woodwork and electricity are recommended for 7A activities because it is found that these activities are more nearly suited to the capacities and interests of these boys. Metalwork and printing, by their very nature, require a higher degree of skill and precision and for these reasons are reserved for 8B boys. The above schedule will, of course, operate throughout in only the unit-shop setup. In the general shop setup the instructional material will have to be adjusted to all ages of junior-high-school pupils. The unit-shop plan excels over the general shop plan in this respect.

The inclusion of home mechanics for girls and foods and textiles for boys in Grade 8A was imperative to conform with one of the major aims of the practical arts in the junior high school; namely, that of *consumer efficiency*. Again no particular technical skill is required in either course but an overview of the field should produce a more intelligent consumer. These courses also make their bid to do something about the woman who is helpless about "fixing things" and the man who is "scared of the kitchen." It is recommended that the home-economics teacher teach foods and textiles, and a practical-arts teacher teach home mechanics.

With the recommendation of home mechanics for the 8A girls comes the unescapable fact that many girls will want to continue shop activities that they had casually experienced in home mechanics. They should be permitted to do so and to work beside the boys as they do in all other types of schoolwork. Some small adjustments might have to be made to fit the 9th-grade courses to the girls but very little should be necessary.

The question of whether this work should be carried on in a general shop or in unit shops will depend entirely upon the setup at the present time at the different schools and the enrollment of the schools. If the school is operating on the unit-shop plan, they should by all means, continue to carry on these activities on this same plan. This would probably mean increasing their equipment in a small way. On the other hand, if the school is operating on the general shop plan (and several are at the present time) it can readily be seen they should continue to carry on their operations in the same manner. This would mean that several schools will have to introduce printing because most of them are doing no work of this kind.

It is further recommended that although there will be schools operating on both the general and the unit-shop plan, their core curriculums should be identical.

Suggestions for Putting the Program Into Operation

The first step. The first logical and feasible step that should be taken to put this proposed program into effect would be for each city to arrange for a drawing or general shop instructor or a committee of instructors to plan a course of planning and blueprint reading for 7B students during the summer vacation of 1939. The course outline, instructional materials, and suggestions could then be handed to instructors in the fall of 1939.

First semester year 1939–40. At the beginning of the school year 1939–40 it would be necessary for the administrators to make adjustments in the school program in order to have five periods per week for practical arts in the seventh, eighth, and ninth grades. This will probably necessitate the rearranging of the entire elective-subjects program. It might in some cases mean the lengthening of the school day. This change is favored by the committee as a means of increasing the field of exploration in the junior high school. It is further suggested that during this first semester, a teacher, or a committee of teachers of home economics, plan a course of study for foods and textiles for 8A boys. The content and methods of such a course would be best understood by such a committee. It is also suggested that the industrial-arts instructor who is to teach home mechanics for girls solicit the assistance of his advanced boys during this first semester and construct tool kits, models, displays, charts, etc., for that course which is soon to be introduced.

Second semester year 1939–40. Foods and textiles courses for boys, and home mechanics for girls, should be introduced at this time. It is also suggested that, as printing is soon to be introduced, the instructors be formally notified so they will start making the necessary adjustments in the layout of their general shops. In all fairness to the most experienced teacher, this early notice is deserved. Most of the schools of the Calumet area have either electrical unit shops or an electricity activity in their general shop. Those who do not have that activity, may well take the same steps suggested for printing. The difficulty, however, of introducing two new activities at the same time is fully appreciated.

First semester year 1940–41. With the early notification of the instructors who are to teach the activities electricity and printing and with vacation time available for the installation of equipment, it is reasonably expected that these two activities may be introduced at this time.

It is admitted by this committee that these suggested steps would necessitate rapid action. Such changes, however, are taking place all over the United States. It is to be remembered, though, that most of the activities of this program are now in operation. For some schools little change would be needed.

City supervisors needed. To centralize the responsibility and supervision of the operation of this suggested program there should be industrial-arts supervisors appointed to work in the junior high schools of the various cities at the beginning of the school year 1939–40. During the first year it will be advisable to have these supervisors divide their day equally between teaching and supervision.

An organization for constant revision. It is further suggested that a central organization be formed among the junior-high-school practical-arts teachers of the various cities of the Calumet area. A

[1]Roberts, W. E., "Program for Instruction in Industrial Arts for the Junior High School," *Industrial Education Magazine*, 37:64–72, March, 1935.

[2]Fales, R. G., "Industrial Arts Program in the Public Schools of New York State," *School and Society*, 46:459–60, October, 1933.

[3]Simon, E. J., "An Integrated Program of Industrial Arts for a Small City," *Education Magazine*, November, 1937.

[4]Rowley, B. H., "Junior High School Industrial Arts," *Sierra Education*, 28:39, November, 1932.

meeting for the purpose of organization should be held in East Chicago during the month of September, 1939, at which time officers should be elected, consisting of president, vice-president, secretary, and treasurer. In addition there should be a committee appointed to draw up a constitution for the organization. The locations of the meetings for the organization should be rotated among the four cities, namely: East Chicago, Hammond, Gary, and Whiting.

This program should be followed during the year 1940–41, and at the last meeting of the school year there should be a committee appointed to make recommendations for any changes in this program which developed out of the past two years' work. If the committee reports any changes that are necessary, they should be made in order to take effect at the beginning of the school year 1941–42. This program should be followed for the next three years to give it a fair trial.

Shop Courses

General Shop Course for Rural Schools

M. C. Winzeler

Archbold-German Township Consolidated Schools,
Archbold, Ohio

An outline which may be helpful to shop instructors in other rural schools.

General shopwork for the rural shop may be defined as such mechanical work as is commonly and economically done in homes and on farms with such tools and equipment as home owners have or find necessary for the work.

Specialized courses in small rural schools are almost impossible at present due to lack of room, equipment, and teaching time. The achievements in this course will not be equal to those in specialized courses, but will be sufficient to demand a pupil's interest in any one subject offered. Time is given for a pupil to specialize on any particular subject in which he is most interested.

The course embraces drawing, metals, electricity, and farm mechanics. Home projects are utilized as they come in, although dependence is not put entirely upon that source. Various types of projects are suggested. Students spend five 50-minute periods per week in this week, shifting from one line of work to another, for 4- to 6-week periods. The entire course covers 36 weeks. At the end of 24 weeks, each part of the course has been introduced to the pupils through purposed projects. The remaining twelve weeks are given over to the pupils to specialize on any subject that particularly interested them.

General Objectives — Ideals

To discover or develop special interests, attitudes, abilities, and habits, such as: Leadership, organizing ability; analysis, orderly procedure; power of imagination, originality, initiative; accuracy in thought and expression; self-reliance; patience, perseverance; neatness; just pride in accomplishment; spirit of co-operation, obedience, punctuality, responsibility, service adaptability, tolerance, courtesy, consideration of others; thrift; interest in and respect for home, school, community.

Particular Objectives — Specific Accomplishments

These are statements of specific accomplishment, expressed in terms of tools, materials, processes, and related information.

Drawing

To Know (knowing)

Tools: Drawing board, T square, 30–60-deg. triangle, 45-deg. triangle, architect's scale, irregular curves, dividers, compasses, ruling pens, drawing pencils, ink, paper.

To Know How to Use or Apply (doing)

Lay out plate with title strip.
Letter the drawing.
Dimension drawing.
Ink (if necessary) and trim.

Sheet Metal

To Know

Tools: Soldering copper, file, tinner's snips (curved and straight), mallet, scratch awl, drill, micrometer, hand groover, folding machine, burring machine, crimping and beading machine, turning machine, wiring machine, stakes, hammers (peening, setting down, riveting).

Materials: Sal ammoniac, solder, flux, tin, copper, zinc, galvanized iron, alloys, muriatic acid, rosin, hydrochloric acid, chloride of zinc.

To Know How to Apply or Use by Doing

Tin a copper; make a lap seam; make a double-lap seam; make a grooved double-lap seam; form a small right-angle burr at the end of a cylinder; set down the seam at the end of a cylinder with a hammer; turn edges for reaming cylindrical articles; turn edge for wiring; rivet sheet-metal joints; solder a seam; sweat a patch; repair home projects.

Other Projects Suggested

Feed scoop, funnel, supply drawers or boxes, tin cup, cooky cutters (any shapes), chicken-coop ventilator, dustpan, water pail, garbage can.

Electricity

To Know

Tools: Side cutting pliers, sockets, bells, buzzers, switches, meters, outlets, etc.

Materials: Knobs, tubes, looms, rigid and flexible conduit, B. X. L. and B. X. armored conductors, pipe.

To Know How to Use or Apply by Doing

Make an end splice and a top splice; make an extension cord for an electrical lamp; wire up one doorbell, one push button, and one dry cell; wire two or three lights in parallel; wire two or three lights in series; replace heating element in electrical appliances at home; make a ceiling outlet; make a wall outlet; make a flush switch outlet.

Hot or Cold Metal

To Know

Tools: Machinist's vise, bastard file, hack saws, cold chisels, anvil, hardie, fuller, forge center punch, twist drill, tongs, emery grinder.

Materials: Blacksmith coal, flux, wrought iron (flat, round, square), mild steel, hack-saw blades.

To Know How to Use or Apply by Doing

Build a forge fire; heating stock to correct heat; squaring, drawing out, and upsetting stock; sharpening and tempering old tools; twisting and bending stock, annealing, tempering stock; welding, punching, and drilling holes; cutting threads, riveting.

Other Projects Suggested

Mending plate; angle iron; corner plate; shoe scraper; cold chisels; folding camp stool; butchering hook; repair link; gate

hook; rivet punch, nail sets; welded ring; screw driver; Christmas-tree stand; hay hook; clevis.

Farm Shop (Concrete, Harness, Farm Machinery)

To Know

Tools for concrete work: Tamper, straightedge, wood float, trowel, grading screen, forms.

Materials for concrete work: Sand, cement, water, lime, reinforcing material, gravel.

Material for harness work: Harness; cockeye, hame clip end, repair squares, concord clip, Conway loop, hame staple, hame clip, concord clip and cockeye, buckle repair clip, needles, awls, shoemaker's thread, beeswax, rivets, No. 10 linen shoe thread, leather, and necessary repair parts.

Materials for machinery work: Farm machinery, tractors, gas engines (brought in by students or farm-implements companies), axle grease, hard oil, machine oil, cylinder oil, heavy oil, transmission oil or grease, kerosene, farm-machine paint.

To Know How to Use and Apply by Doing

Make a 1:2:3 mixture with coarse aggregate less than 1 in. in diameter; make a 1:2:3 mixture with coarse aggregate not over ¾ in. in diameter; make a 1:2:3 mixture with coarse aggregate less than 1½ in. in diameter.

Projects: Flower box, hog trough, fence posts; make a stitched splice; attach a buckle to a strap by riveting; repair a trace using two hame clips and a hook; attach a snap with Conway loop; wire ignition system on a tractor; examine lubrication system; time the engine; repair tractor; repair farm machinery.

Suggested References

Farm Mechanics, L. L. Scranton, Interstate Publishing Co., Danville, Ill.

Farmer's Shop Book, Louis M. Roehl, Bruce Publishing Co., Milwaukee, Wis.

Fitting Farm Tools, Revised Edition, Roehl, Bruce Publishing Co., Milwaukee, Wis.

Mechanical Drawing, First Year, Ermeling, Fischer and Greene, Bruce Publishing Co., Milwaukee, Wis.

Beginning Problems in Mechanical Drawing, Bennett, Manual Arts Press, Peoria, Ill.

Essentials of Applied Electricity, E. W. Jones, Bruce Publishing Co., Milwaukee, Wis.

Practical Electricity for Beginners, Willoughby, Manual Arts Press, Peoria, Ill.

Fundamentals of House Wiring, Willoughby, Manual Arts Press, Peoria, Ill.

Elements of Sheet Metal Work, R. Welch, Bruce Publishing Co., Milwaukee, Wis.

Forge Note Book, Coleman, Bruce Publishing Co., Milwaukee, Wis.

Bench Metal Workers, Selvidge and Christy, Manual Arts Press, Peoria, Ill.

Sheet Metal Work, Trew and Bird, Manual Arts Press, Peoria, Ill.

Shop Management in Rural High Schools, Roehl, Bruce Publishing Co., Milwaukee, Wis.

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION Magazine, Bruce Publishing Co., Milwaukee, Wis.

Farm Mechanics Activities

Russell H. Landis

Assistant Professor,
Industrial-Arts Department,
Eastern Illinois State Teachers College,
Charleston, Illinois

A statement of the type of work covered, the tools and equipment needed, the materials required, and the jobs that are likely to be undertaken.

The terms *farm mechanics, farm engineering, farm shop,* and *agricultural mechanics* seem to be applied by the various schools employing these titles to courses which have the general content of a rural home-mechanics course. An investigation of the value and content of a course in farm mechanics, as conducted by a college class under the guidance of the author, led to the development of a practical outline for such a course.

The value of a course of study can be estimated, first, by a consideration of the situations in which the knowledge derived can be applied; second, by a consideration of the people who will benefit by that knowledge. In a course of farm mechanics, the knowledge derived can be applied to:

1. The improvement and care of the farm home.
2. The maintenance and care of the farm repair shop.
3. The supplementing of the rural-school program.
4. The improvement and care of various farm buildings.
5. The conservation and improvement of farm lands.
6. The maintenance and care of farm machinery.
7. The care and protection of farm animals.

Among those who benefit, directly or indirectly, are:

1. The farm boy, or the pupil.
2. The teacher of the class, or of the rural school.
3. The farmer.
4. The farm laborer.
5. The farmer's wife or daughter.

A great fault in many courses of farm mechanics is the preponderance of the work done in one phase and the exclusion of valuable experience in other units of work. A consideration of the entire field led to the selection of the following activities, as worthy of inclusion in a course of farm mechanics:

1. Woodwork, including carpentry.
2. Plumbing.
3. Electrical work.
4. Rope work.
5. Leather work.
6. Concrete work.
7. Metalwork, including forge work.
8. Wood and metal finishing.
9. Drawing.

No mention is made of auto, tractor, and gas-engine maintenance and repair, as this phase of work is usually taught in a distinct and separate course.

It is essential that a minimum of materials and tools be included in a farm-mechanics course, both for economical reasons and because the usual farm shop is not elaborately equipped. The addition of just a little in the way of materials or tools to the average farm equipment will greatly increase the possibilities of the work that can be done. It is understood that materials and tools are interchangeable, and the location of each under certain classifications is done here chiefly to avoid duplication.

Necessary materials for the conduct of a course in farm mechanics would then include:

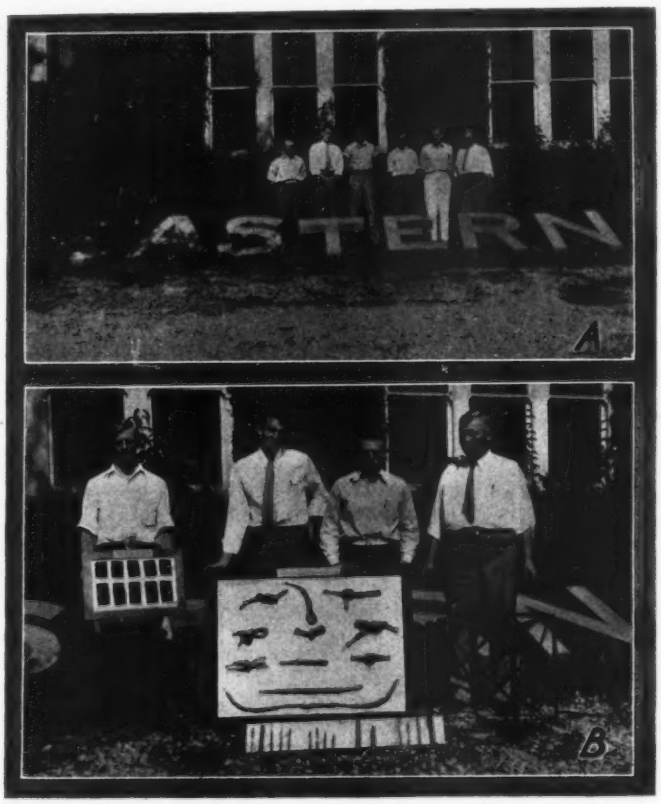
1. *For woodwork, including carpentry:* Nails, screening, locks, lath, bolts, screws, hinges, lumber, tacks.
2. *For plumbing:* Elbows, lead, tees, unions, bushings, couplings, reducing coupling, plugs, caps, nipples, pipe, white lead, washers — rubber, leather.
3. *For electrical work:* Flux, wire tape, insulators, flexible conduit, conduit, solder, electric wire, fixtures — wall plugs, switches, light outlets.
4. *For rope work:* String or cord, 3-strand rope.
5. *For leather work:* Assorted belts, belt

lacings, leather, thread, copper rivets, harness, wax, harness oil or grease.

6. *For concrete work:* Sand, cement, gravel, reenforcing steel.

7. *For metalwork,* including forge work: Sheet tin, black iron, tool steel, babbitt, tinned rivets, staples, galvanized iron, mild steel, brass sheet and tubing, iron rivets, galvanized wire, fencing wire.

8. *For wood and metal finishing:* Putty, upholstery supplies, rags, plaster, house and barn paint, varnish, shellac, glazier's points, steel wool, sandpaper, lime, enamel, turpentine, alcohol.



A. Concrete work done by a class in farm mechanics at Eastern Illinois State Teachers College, Summer, 1937.
B. Belt lacing, rope knots and splices, toolmaking and tempering, and a washtub stand. Work done by class in farm mechanics at Eastern Illinois State Teachers College, Summer, 1937

9. *For drawing:* Drawing paper, tracing paper, cross-section paper.

In the following list of tools, no mention is made of tools or equipment which can be made or constructed by the worker himself.

1. *Woodwork, including carpentry:* Ratchet brace, auger bits, 1/4 to 1 in., by 16ths; chisels, 1/4, 1/2, and 1 in.; mill file, 8 in.; claw hammer, 16 oz.; block plane; cross-cut saw, 26 in., 10 pt.; spirit level; try square; burnisher; compass saw; sloyd knife; hand drill and bits; bit-stock screw driver, 3/8 in.; oilstone, natural or artificial; Rose countersink; wood file, 10 in.; tack hammer; jack plane, 14 in.; ripsaw, 26 in. 5½ pt.; steel square, scraper; coping saw; screw driver (medium), pliers.

2. *Plumbing:* Large pipe wrench, pipe-threading dies; small pipe wrench; hack saw; mill files, assorted.

3. *Electrical work:* Insulated pliers, soldering copper.

4. *Leatherwork:* Combination punch, sewing awl, harness needles, scissors.

5. *Concrete work:* Sand shovel, plasterer's trowel, groover, brush, buckets, bricklayer's trowel, edger, sieve.

6. *Metalwork, including forge:* Setting-down hammer; taps and dies, 1/8 to 1 in.; end wrenches; tin snips, curved and straight; punches; dividers; inside calipers; cold and hot hardies; blacksmith's hammer; forge tongs; socket wrenches, set; bench grinder; blow torch; monkey wrench; rivet sets; cold chisels; outside calipers; hardy hammers; anvil; hand forge; melting ladle.

7. *Wood and metal finishing:* Covered cans, putty knife, paint brushes, jars, scrapers.

8. *Drawing:* Rule or yardstick; T square; protractor; eraser; combination dividers; 30-, 60-, and 45-deg. triangles; pencils; board.

The content of any course in farm mechanics will vary according to local needs, available equipment and materials, and the length of the course. No attempt has here been made to set up an ideal course, but from the jobs listed an adequate sampling may be chosen to provide a well-rounded course in farm mechanics. These jobs were selected by a careful study of texts and by drawing upon practical experience and knowledge of existing rural conditions. While not inclusive, it is felt the jobs here listed are quite comprehensive.

1. *For woodwork, including carpentry:* Workbench; bolt, nail, and screw cabinet; portable tool box; miter box; hand-saw filing clamp; kitchen stool and ladder; wood box; ironing board and stand; kitchen table; road or field drag; hayrack; rabbit trap; farm gate; hog self-feeder; hog crate; milking stool; hog brooder house; chicken brooder house; low platform wheelbarrow; oats sprouter; auto-trailer bed; hog-feeding trough; interior and exterior house repair; chicken house; equipment shed; window flower box; lattice; machine guards; water gap (gate); renewing tool handles; tool cabinet; dough-mixing board; nail and staple box; sawhorse; wagon jack; folding bench or table; screen door and window screen; shelving; lawn or porch seat; 2-, 3-, or 4-horse evener; wagon bed; stock rack (wagon); ladders; cattle-feed rack; sheep-feed rack; portable loading chute; poultry feeder; trap nests; orchard ladder; seed-corn testing box; playground equipment — teeter, merry-go-round, swing, sled; garage; chicken coop; birdhouse; weather stripping; fences and repair; wagon tongue; care of tools.

2. *For plumbing:* Threading pipe; bending pipe, laying drainage tile, installing shower, repair faucets, cutting and replacing washer, insulating pipes, installing hydraulic ram, cutting pipe, thawing frozen pipe line, cleaning pipe lines, replace fittings, repair pump, installing water system, pipe joining and joints, precautions and safety measures.

3. *For electrical work:* Installing doorbell; installing wind charger; attaching wire to plugs; wire splicing; battery testing; care of battery; erecting radio aerial; connecting radio; installing 2-way switch; housewiring — outlets, etc.; repairing irons, sweepers, etc.; safety precautions; underwriters' specifications.

4. *For rope work:* Knots, whipping, halter making, splicing, crowning, threading blocks, care of rope.

5. *For leatherwork:* Belt lacing, winding handles, harness repair, tooling, tanning and curing hides. braiding, shoe re-

pair, sewing, specialty work, care of harness and belting.

6. *For concrete work:* Garage drive and runways, watering trough, chimney caps, garden bench or seat, spring casing, bird bath, lay building tile, cistern construction, pedestal, engine foundation, lawn roller, water tank, outdoor fireplace, dipping tank, curing concrete, sidewalk, steps, fence posts, window flower box, well curb or platform, feeding floor (platform), septic tank, lay brick, repair plaster wall, rain leaders, home plate (baseball), hot-bed foundation, incinerator, building foundations, culverts and erosion dams, care and use of tools.

7. *For metalwork, including forge:* Hook-and-eye hinge; tempering tools; repair gutters, spouts, etc.; put handles on buckets; funnels; snow shovel; sharpen harrow spikes, etc.; gate hook and staple; make chisel, punch, etc.; solder hole in buckets, etc.; replace stove pipes; grain scoop; liquid measures; grind mower knives; replace mower knife sections; sharpen and grind tools; make knives of saws, files, etc.; replace links in chains; make forge tools; general machine repair; end gate-rod; re-edge scoop shovel; tub rack; shelf brackets; bend and shape metal; repair windmill; replace furnace damper; metal farm gate; sharpen knives; point wedge; reshape log hook; weld chain links; build forge fire; make machine guards; hay hook; lap ring; fit irons to single and double trees; milk cooler; sharpen hoe; reinsulate furnace, care of tools; repair flashing and roofs.

8. *For wood and metal finishing:* Removing paint, cleaning wallpaper, house and barn painting, furniture refinishing, mixing paint, cleaning painted surfaces, paperhanging, replacing pane of glass, interior finishing, furniture reupholstering, care of brushes.

9. *For drawing:* Blueprint reading, freehand drawing, scale drawing, planning and plan drawing.

References

Roehl, Louis M., *The Farmer's Shop Book.* Bruce Publishing Company, Milwaukee, Wis.

Struck, F. Theodore, *Construction and Repair Work for the Farm.* Houghton-Mifflin Co., New York City.

Auto-Shop Organization

Lyle J. Shaw

High School,
Escanaba, Michigan

"The man of today probably travels at least a hundred times as far during his lifetime as a man 50 years ago. This change has come about mainly through the use of the automobile — it has brought us mobility and all but freed us from the limitations of time and space. A knowledge of this remarkable machine and the way in which it has influenced our life and culture would be worth having in and for itself."[1]

Why is it, then, that so few schools offer a real course in automotives? The main reason is apparently the lack of information concerning the time, space, and equipment necessary to teach such work. Contrary to prevalent opinion, it does not require very much space or equipment to teach the underlying principles of the automobile. On the other hand, there is no limit to the vastness of such a course. Either one corner of a wood shop and a few dollars worth of equipment or half the school and thousands of dollars worth of tools and machinery may be allocated to the teaching of auto shop. As usual, the commendable practice lies between the extremes.

Although there are many plans or organizations in the teaching of automotives in schools, the two most general are the unit work and the road-job plans with their variations. In the unit-work system, the different units of the car are set up in the shop, and the pupils work on the various parts. With the road-job plan, the boys actually make the repairs, after which the cars are again sent out on the road.

In the small shop, or the shop where there is no way of driving a car inside for road jobs, the unit-work plan is more practicable. This unit-work method of teaching is very effective in a comprehensive general shop. It is most successful when taught by means of instruction sheets. Since the operations in auto repairs and upkeep are practically complete in themselves, the form of instruction sheet needed is the job-sheet type.

One of the best ways to examine the unit work is to consider its advantages and disadvantages separately. Let us first discuss the advantages of this teaching program.

1. There need be no limitations in teaching as to the course length, the time used, or the space required.

2. It removes the responsibilities that are connected with road jobs, for the repaired parts are never used on a car again.

3. The instructor can follow his outline closely, for he never has to wait for jobs to come in; they are always there.

There are several disadvantages connected with the unit-work plan. They are as follows:

1. The pupils have a tendency to become careless and to feel that the job is not of real importance since the automobile parts repaired or replaced will never be in use again.

2. Pupils have a tendency not to want to complete an operation, such as the replacing of lock washers and cotter pins.

3. It is difficult to secure up-to-date parts, for car designs change so rapidly. Not many school boards would supply good or new parts every time that the designs change. It is not so easy to secure materials from late-model cars that have to be discarded because mechanics frequently remove the good parts and keep them in for future use.

Next, we shall consider the road-job plan, first studying its advantages.

A plea for more attention to a study of the automobile in our schools.

1. This method of teaching appeals to the pupil more, and in order to get the best results, the students must be interested. Nearly every boy prefers to work on real cars and engines that actually run.

2. The largest advantage of this plan lies in the fact that it offers pupils the opportunity of learning by actual experience. It is a well-established principle of teaching that people learn best by practicing under real, practical working conditions.

Now let us study the disadvantages of the road-job plan.

1. One great disadvantage is the securing of the right kind of jobs at the proper time to fit in with the shop schedule and outline. For example, no instructor would want to start a pupil in on valve grinding the first day.

2. In large classes it is difficult for the instructor to check every operation, and this inspection is very essential on road jobs.

3. This plan is not suitable for younger pupils; rather, it is more adaptable for eleventh and twelfth grades.

4. There is too much danger of the pupils damaging the cars while learning. For instance, just one small mistake made on some part, such as the cylinders, might ruin the entire engine.

5. This plan places too much responsibility on the instructor. For example, if a pupil should leave a cotter pin out of a front-wheel spindle, this omission might cause the death of someone, due to the wheel's coming off while the car is on the road.

Now that we have discussed both the

[1] Whitney, Albert Wurts, *Man and the Motor Car,* Introduction, iv.

unit-work and the road-job plans, let us consider a variation of these two. It is a combination of both, in which the instructor follows the unit-work plan entirely at the beginning of the course and gradually proceeds into road jobs.

The number of road jobs to have in the shop at any one time depends upon the size of the shop, equipment, and the number of pupils in the class. At no time though should there be more road jobs than the instructor has time to check in detail. This combination plan of organization is more satisfactory from the standpoint of pupil instruction and teacher responsibility. With this method, too, the advantages of both the unit work and road jobs are maintained and to a great extent the disadvantages removed.

The instructor should spend about one third of his time in classroom discussion and the remainder in actual shop practice. Either an adjoining classroom or armchairs in the shop will help greatly to facilitate class discussion. In addition to job sheets, textbooks, and reference books, educational literature from such sources as automobile manufacturers, battery, electrical, tire and tool companies is advantageous for use in the shop.

Beginning Hand Composition

M. R. Stewart

Teacher of Printing,
Boys' Technical High School,
Milwaukee, Wisconsin

An outline of instruction that may be of assistance to teachers of industrial-arts printing.

Part I

Care and Distribution of Rules and Materials

1. Sort and distribute leads and slugs.
2. Sort and distribute reglets.
3. Sort and distribute furniture.
4. Sort and distribute rules.
5. Care of proof press; oil, clean, ink up and clean up, change tympan.
6. Take stone proofs of electrotype.
7. Take proof press proofs of electrotype.
8. Tie up linotype type forms.
9. Take proof of linotype forms.
10. Wash forms, remove string, and place in galley.
11. Lock up electrotype and take lockup proof on proof press.
12. Lock up type form and take lockup proof on proof press.
13. Unlock and break up press forms.
14. Pick up and transfer type forms from galley to stone and vice versa.
15. Lock up type forms and take stone proof; take proof on press proof.
16. Unlock type form, tie up type and replace on galley.
17. Care of plates, engravings, half tones, etc.
18. Study and compare spaces and quads.
19. Study line gauge and its application to printing material.
20. Study of type faces and parts of a type.

Part II

Straight-Matter Composition

21. Learn the lay of job case.
22. Set a stick to measure.
23. Set the alphabet — capitals and lower case; figures; marks; ligatures.
24. Set and study characteristics of the characters d, b, p, q, n, u, 6, and 9.
25. Remove type from stick; correct position on galley.
26. Set words containing the ligatures.
27. Divide words; how to find correct division of words in dictionary.
28. Justify lines; study of spaces and quads; relative value in units of spaces; how applied to straight matter.
29. Space sentence endings; indentions for paragraphs.
30. Center lines; position of quads and spaces in the line.
31. Measure units; simple tabular composition; comparing units with type.
32. Set columns of words; applying unit values of spaces and quads.
33. Straight-matter composition; knowledge of division of words and correct spacing.
34. Difficult composition; combining centering lines and simple tabular work.

Poetry

35. Set poetry; rules for indention when alternate lines rhyme.
36. Set poetry; comparison of rhyme and "beats."
37. Set poetry; rhyming lines appearing in pairs.
38. Set poetry; in which the first and last lines are rhyming ones with a couplet placed between.
39. Set poetry; test lesson.

Indentions

40. Indentions; paragraph and hanging indentions.
41. Hanging indentions beginning with a figure.
42. Hanging indentions beginning with a letter.
43. Combined forms of hanging indention and subheadings.
44. Combined forms of hanging indentions to show groups of equal rank.
45. Test on hanging indentions.

Typewriter Type

46. Study of typewriter faces; number of characters to an inch; comparison of type body and spaces.
47. Simple spacing of typewriter type; irregular line endings.
48. Spacing of lines in typewriter type — solid, single spaced, and double spaced.
49. Tabular exercise using typewriter type.
50. Computations of space necessary for given amount of copy set in typewriter type.
51. Business letter set in typewriter type.
52. Form letter set in typewriter type.
53. Form letter spaced and placed correctly on printed letterhead.
54. Form letter using electrotypes.
55. Test of tabular setting, using typewriter type.

Initial Letters

56. Use of initial letters in beginning of paragraphs.
57. Irregularly shaped letters; care to be observed in space allowed.
58. Test on use of space around initial letter.
59. Tone harmony as applied to choice of initial letter.
60. Shape harmony as applied to choice of initial letter.
61. Choice of initials to use with various sizes of body type.
62. Test on use of initials and body type.
63. Raised initials.
64. Ornamental initials; surrounding space.
65. Test for initial letters.

Headings

66. Running heads; position of page numbers.
67. Inverted pyramid.
68. Test on setting inverted pyramids.
69. The step heading and method of setting.
70. Test on setting of step headings.
71. Combination test on step headings and hanging indention.

Composition with Cuts

72. Composition with cuts; margin allowance.
73. Composition with cuts; fitting in copy.
74. Composition with cuts of various sizes.
75. Test on composition with cuts.

As a field, however fertile, cannot be fruitful without cultivation, neither can a mind without learning. — *Cicero.*

When you know a thing, to hold that you know it; when you do not know a thing, to allow that you do not know it; this is knowledge. — *Confucius.*

Related Science

Harry R. Wilson

Eastern High School,
Lansing, Michigan

A comprehensive and thorough discussion of the need for, and of the type of related-science work that is to be given to students enrolled in industrial-arts and vocational courses.

Industrial-arts and vocational-education courses have been frequently accused (and maybe rightly so) of turning out only partially prepared individuals who may be trained as good craftsmen, but who are lacking many of the things which go to make a well-educated person. It is believed that the teacher of related subjects can do much to fill this gap. Labor and industrial leaders tell us that much of the trouble we are experiencing in industry today is due to people who are trained specialists in crafts and professions but who, in subjects of an economic or political nature, show complete ignorance. Their lack of knowledge in matters of health or of their civic responsibilities is also much in evidence.

Vocational-industrial education has been interpreted by many in both theory and practice as purely *trade education* — in their thoughts craft efficiency has subordinated all other aspects. Graduates of our industrial courses and also well-seasoned craftsmen have been heard debating among themselves the advisability or inadvisability of joining a trade union, but without any background of knowledge on which to base their assumptions or influence their decisions. In matters of health and hygiene they lack a considerable amount of knowledge; they are all but defenseless in face of an ever increasing barrage of ballyhoo advertising and propaganda which confronts both young and old today. No student is going to be merely a tradesman and nothing else. He must at some period of his life be a member of a family; he may be a home owner or part owner; he is a citizen; and possibly will be a member of some political unit or social group. As well as being a producer, he is a consumer — a fact which many of our industrial leaders and prominent educators have forgotten in the past.

We must not allow ourselves to be so blinded by the technical aspects of a trade that we deny or ignore the other needs of our industrial students. According to a general agreement among those in the educational field, a well-rounded education should prepare an individual for participation in social-civic, economic-vocational, and individualistic-avocational activities. Our vocational education seems to have stressed the economic-vocational to the neglect of the rest. If vocational education is to be presented in its fullest and broadest sense, it should, in order to cover these three divisions, include a study of economics, civics, and politics. History should be taught not as a conglomeration of dates and facts, but as it affects present-day conditions. Related science should give intelligence and initiative in dealing with the materials and agents of production, not neglecting the knowledge which will give our students an intelligent consumers' choice of the materials that are in everyday use. They need also a knowledge of health and sane living and an understanding of how the individual may happily and properly spend his leisure time. Above all, stress should be placed on adaptability — the fact that, in this ever changing world of industry, a trade may be here today and gone tomorrow — that in preparing for one trade it is better to look ahead and, if possible, foresee the changes which are likely to occur, and be prepared for them.

The blacksmith who, during the shoeing of horses saw in the automobile his future rival and studied the internal-combustion engine, was the one who stayed in business when the man with little foresight, who did not anticipate the passing of Dobbin shut up his shop.

Related Science

How many of our related courses are really *related* in the true sense of the word? In our related-science courses, for instance, there is a tendency to follow the pattern set down by science courses whose aims are entirely different from those in the field of industrial arts and vocational-industrial education. All our courses must be outlined and construed with one thought in mind above all others — we are preparing students to enter industry, to go out and make a living when they are through school. Their goal then is industry — not college. There should be, and rightly so, as much difference between the college-preparatory science and the industrial-preparatory science as there is between chalk and cheese. The one is preparing the student for further intensive theoretical training and the other preparing him for direct and immediate participation in industry. The one stresses theory and mathematics — the other the practical uses of material in industry.

There is a danger however, which we must not overlook, in making our industrial-science courses so closely related to work. We are apt to forget that our student is a citizen also of the community and as such will, when he reaches voting age, have a voice in the affairs of his town or city. Such matters as water-conditioning plants and sewage-disposal systems are usually voted for or against by the people in the immediate district. In such matters a citizen needs scientific knowledge so that he may vote intelligently. It is difficult for a person not so equipped to *see through* the propaganda of small *pressure groups* who usually have quite a lot to say when such projects are put before the voters for their decision.

The health of the potential worker is another matter which related-science teachers should keep in mind. During the preparation of this article I consulted many of the graduates of our course who were employed in different industries in order to get their opinion as to what topics had helped them more than others. Several of them stressed particularly this matter of health and occupational diseases. According to the Michigan Workmen's Compensation Law the term *occupational disease* means "a disease which is due to causes and conditions which are characteristic of and peculiar to a particular trade, occupation, process, or employment." The following are a few of those listed which deal particularly with metals and metallic compounds:

1. Lead poisoning or its sequelae. This includes "any process involving the use of or direct contact with lead or its preparations or compounds."
2. Poisoning by zinc, its preparations, compounds, or alloys.
3. Poisoning by mercury, its preparations or compounds.
4. Dope poisoning. This includes "any substance used as or in conjunction with a solvent for acetate of cellulose or nitrocellulose."
5. Chrome ulceration or chrome poisoning. This includes any "process involving the use of or direct contact with chromic acid or bichromate of ammonium, potassium, or sodium or their preparations." (Chromic acid is used in chromium plating.)
6. Carbon-monoxide poisoning. "Any process involving direct exposure to carbon monoxide in buildings, sheds, or enclosed places."

(It is surprising how many cases of this we might find in homes where gas stoves are used and not sufficient ventilation provided. A college professor told me it cost him $500 to find this was the reason for his wife's constant headaches.)

7. Poisoning by sulphuric, hydrochloric, or hydrofluoric acid.
8. Respiratory, gastrointestinal, or physiological nerve or eye disorders due to contact with petroleum products or their fumes.
9. Disabilities arising from blisters or abrasions. This includes "any process involving continuous friction, rubbing or vibration of the part affected."
10. Pneumoconiosis. A disability arising from the "quarrying, cutting, crushing, grinding, or polishing of metal."

(Continued on page 14A)

STANLEY "Boy Proof" TOOLS for School Shops

No. 52½ 10 oz. HAMMER

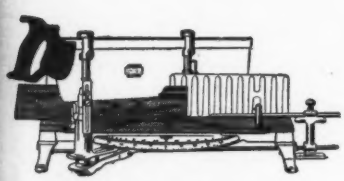
Super heat treated head. Evertite oil treated handle of selected straight grain hickory. Patented wedges.

No. R40 EVERLASTING CHISEL

No lost or battered handles. Rubber composition handle, practically unbreakable, moulded about shank. Blade, shank and head one piece of finest steel.

No. 626 HAND DRILL

New chuck with hairpin type springs. Heavy crank, solid wheel, several other important features. ⅜" chuck capacity. Hand Drill No. 617 has ¼" chuck capacity.



No. 2246 MITRE BOX

Simplified design. Swivel and uprights one piece of malleable iron. Malleable iron saw guides with roller bearings.

No. 80M SCRAPER

Practically unbreakable. Body and handles one piece of malleable iron.

WOODWORKING AND FARM SHOPS

The most complete line offered by one manufacturer.

ELECTRICAL SHOPS

Hammers, Bit Braces, Bit Extensions, Screw Drivers, etc.

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Hammers, Chisels, Punches, etc.

AUTOMOBILE SHOPS

Body and Fender Tools, Hammers, Chisels, Punches, Pliers, Files, Screw Drivers, etc.

MACHINE SHOPS

Hammers, Rules, Chisels, Punches, Levels, etc.

FORGE SHOPS

Anvil Tools, Tongs, Hammers, etc.

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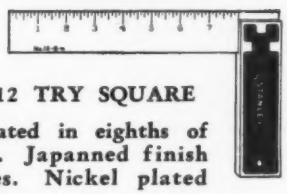
Catalog 34A, 204 pages, contains much useful material in addition to complete descriptions and specifications of Stanley Tools. Get your free copy and use it as a handbook for tools and their use.

STANLEY
TRADE MARK



No. 12 TRY SQUARE

Graduated in eighths of inches. Japanned finish handles. Nickel plated blade.

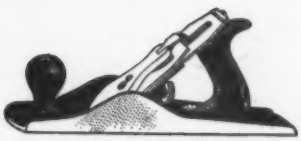
STANLEY ELECTRIC SOLDERING IRONS

No. 340

95 Watts

Seven Other Sizes — Wound For Standard Voltages

Quick Heating — even temperature. Replaceable tips. Instant adjustment of handle for length. Hermetically sealed unit. Long life and dependability.



No. 5¼ JUNIOR JACK

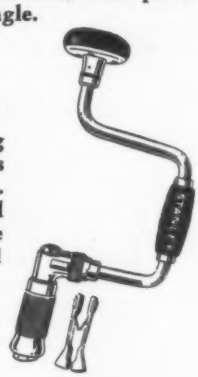
Well balanced, lightweight. Ideal size for Junior High School student.

No. 118 BLOCK PLANE

All steel. Minimum number of parts. Lowest cutting angle.

No. 919 BIT BRACE

Self centering chuck, all parts locked in place. Bronze bushed ball bearing head. Made with 8, 10, 12 and 14 inch sweep.

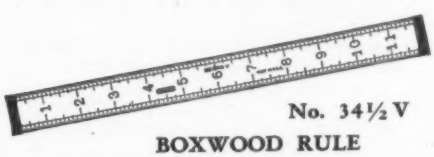


No. 20 SCREW DRIVER

Standard blade. Blade, shank and head hot forged from one piece of steel.

No. 151M SPOKE SHAVE

Malleable Iron—practically unbreakable. Cutters of finest steel correctly hardened, tempered and sharpened.



No. 34½ V BOXWOOD RULE

Improved vertical figures — easy to read in any position. One side graduated in eighths of inches — other side in sixteenths. Brass tips protect ends.

STANLEY TOOLS EDUCATIONAL DEPARTMENT DIVISION OF THE STANLEY WORKS NEW BRITAIN CONNECTICUT

Woodworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Bench
- *a)* Shop, with hardwood tops, 1¾ in. or over in thickness, built up of strips with tongue-and-groove joints, the top to project far enough to allow a rapid-acting or continuous-screw vise to be attached.
  It is a good idea to order a 1-in. birch or maple board wide enough to cover the working face of the bench at the time of buying the benches. This board can then be fastened to the top proper with screws and may be conveniently replaced when worn. The benches should be made of thoroughly kiln-dried lumber throughout. They may be either plain or of 6-drawer type.
- *b)* Glue
- *c)* Stain, with metal-covered top
- *d)* Teacher's demonstration

Blackboard — permanent or portable

Bookcase

Bulletin Board

Cabinets — wood or metal for filing class records, instruction sheets, drawings, etc.

Chairs — teacher's and tablet-arm

Core Oven — for patternmaking class

Desk — teacher's, with drawer compartments

Furnace — for melting soft metals (for patternmaking class)

Glue Pot — 1-qt. or 2-qt. electric, gas, or steam heat

Glue Warmer or Cooker — 1- to 5-gal. capacity

Grinder
- *a)* Automatic knife, direct-motor-drive type. Size to suit largest knife used in school shop, complete with water pump, grinding wheel, and automatic stops
- *b)* Bench, hand or power
- *c)* Bench, motor-in-head. Motor bearings to be completely housed, wheels to be equipped with safety flanges and carefully guarded throughout. One fine-grit, and one coarse-grit wheel
- *d)* Revolving oilstone, pedestal type, with one fine and one coarse oilstone

Jointer
- *a)* 6-in. or 8-in. portable jointer. Table to be fitted for rabbeting. Safety-cylinder type, equipped with safety guard
- *b)* 12-in., 16-in., or 18-in. direct-motor-drive, ball-bearing. Cylinder to be of safety-head type. Table to be fitted for rabbeting. Jointer to be equipped with safety guard

Lantern — Stereopticon-view machine for opaque objects and standard-type lantern slides

Lathes
- *a)* 6-in. to 16-in. motor-in-head, motor-in-base, or belt-driven speed lathe, to take 24 in., 36 in., 48 in., 60 in., or 72 in. between centers. Each to be complete with cup center, spur center, faceplate, rosette chuck, tool rests, and center drift for head block
- *b)* Patternmakers', with end faceplate provision. Lathe to be of direct-motor-drive type, equipped with variable-speed motor, faceplates and floor stand. (For patternmaking class)

Mortiser
- *a)* Direct-motor-drive, or belt-driven, hollow-chisel mortiser, foot feed. Table to be of the tilting type with hold-down clamps and stop rod
- *b)* Portable, vertical, hollow-chisel mortiser, bench type

Planer — 12-in., 18-in., 20-in., 24-in., or 30-in. motor or belt-driven, single-surface planer. Safety-head cylinder, three-knife type, fitted with good-grade steel knives. Knife-setting and jointing device complete with bar should be mounted on machine if possible

Sander
- *a)* Belt, direct-motor-drive
- *b)* Disk, motor or belt-driven
- *c)* Oscillating-spindle, motor-driven
- *d)* Portable, hand-plane type, direct motor drive
- *e)* Vertical-spindle and disk sander

Saws
- *a)* Band saw, 20-in. to 36-in., motor drive. Upper and lower wheels to be completely guarded. Table to tilt to 45 deg.
- *b)* Combination, band saw, crosscut saw, ripsaw, and mortiser. Machine to be completely guarded
- *c)* Cut-off, pedestal or swing type to be fitted with 12-in. to 16-in. saw
- *d)* Filing machine, direct motor drive
- *e)* Jig, direct-motor or belt driven
- *f)* Portable band saw, 16 in. to 20 in. ball-bearing, motor-driven
- *g)* Saw bench, direct connected to motor, and to have both rip and crosscut saws. Rip and crosscut gauges also to be provided
- *h)* Universal saw bench, 14 in. to 16 in., motor driven
- *j)* Variety saw bench, motor driven, tilting table, with universal sliding table. The arbor is to be fitted for a dado head, and the table is to be slotted accordingly, The saw is to be equipped with ripping fence and miter cut-off gauges

Shaper
- *a)* Motor drive, single or double spindle. Table to be equipped with removable center plate
- *b)* Portable shaper or router with a suitable selection of cutters

Tenoner — single end, with coping heads and cut-off saw

Vises — rapid-acting or solid-nut type woodworking-bench vises, 7-in. to 10-in. face

Wood Trimmers — complete with all gauges and taper pins. Base of trimmer to be slotted and laid out for degree settings (for patternmaking class)

Woodworking—Small Tools

Awls — brad, assorted sizes

Bevels
- *a)* Protractor
- *b)* Sliding T, 8 in.

Bits
- *a)* Auger, 3/16 in. to 1 in. inclusive, by 16ths
- *b)* Auger, 3/16 in. to ½ in. inclusive, by 16ths
- *c)* Braces, ratchet-type, 8 in., 10 in., 12 in., or 14 in. sweep
- *d)* Countersink, for wood, rose pattern, ½ in. and ⅝ in.
- *e)* Dowel, square shank, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.
- *f)* Expansive, ⅞ in. to 1½ in.
- *g)* Expansive, ⅞ in. to 3 in.
- *h)* Forstner, square shank, ¼ in. to ½ in. inclusive, by 16ths
- *j)* Screw driver, square shank, ¼ in., 5/16 in., ⅜ in.
- *k)* Twist drill for wood, square shank, 1/16 in. to ⅜ in. inclusive, by 16ths
- *l)* Twist drill, straight shank, 1/16 in. to ⅜ in., inclusive, by 32nds

Blowtorch

Brooms

Brushes
- *a)* Bench duster, 10 in.
- *b)* Floor
- *c)* Glue, round, 1½ in. and ¾ in.
- *d)* Glue, round, 1½ in.
- *e)* Marking, camel's-hair, No. 1 and No. 2
- *f)* Varnish, flowing, 2 in. and 2½ in.
- *g)* Varnish, flat, ½ in., ¾ in., and 1 in.

Burnishers — oval or round

Can Opener

Carving Tools
- *a)* Sets containing 6 tools
- *b)* Sets containing 12 tools

Chisels
- *a)* Cold, machinists', ⅜ in. and ½ in.
- *b)* Mortising chisel and bits, ¼ in. to ⅝ in. by 16ths
- *c)* Socket-firmer, bevel edge, ⅛ in., ¼ in., ½ in., ¾ in., 1 in., and 1½ in.
- *d)* Socket-firmer, plain edge, ½ in., ¾ in., and 1 in.
- *e)* Tanged-firmer, bevel edge, ⅛ in., ¼ in., ½ in., ¾ in., 1 in., and 1¼ in.

Clamps
- *a)* Bar, 24 in., 36 in., 48 in., and 60 in.
- *b)* Hand-screw, 4 in., 5 in., 6 in., 7 in., 8 in., 10 in., 12 in., and 14 in.
- *c)* Malleable-iron C, 4 in., 6 in., and 8 in.

Dividers — wing, 6 in. and 10 in.

Dowel Plate — 6 in. long

Doweling Jigs — with bushings

Drawknives — 7 in.

Drill
- *a)* Automatic hand, with 8 drill points
- *b)* Chuck, 0 to ⅜ in.
- *c)* Hand, 0 to ⅜ in., for round-shank drills
- *d)* Star, for concrete, ½ in. and ¾ in.

Files
- *a)* Auger bit, assorted, 6 in.
- *b)* Cabinet, 8 in. and 10 in.
- *c)* Card and brush
- *d)* Flat, wood, 10 in.
- *e)* Mill, bastard cut, 10 in.
- *f)* Round, bastard cut, 12 in.
- *g)* Taper, slim, 5½ in. and 7 in.

First-Aid Cabinet and Supplies

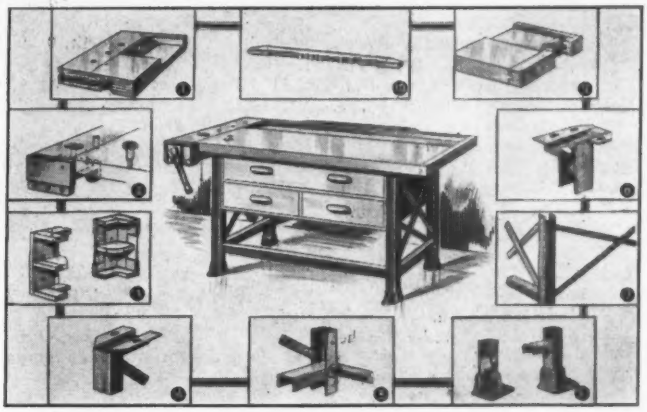
Gauges
- *a)* Bit, adjustable
- *b)* Jointer
- *c)* Marking, metal or hardwood
- *d)* Mortise, metal or hardwood
- *e)* Panel

Glass Cutter

(Continued on page 12A)

It Pays to MODERNIZE with Hamilton

It pays to modernize . . . new equipment provides for more students per room . . . discipline is easier to maintain with properly designed furniture . . . and students learn better when working with well-proportioned equipment. The school board, too, will welcome the new equipment because of the "built-to-take-it" construction.

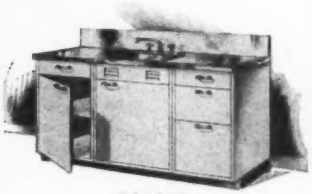


FOR STRENGTH...STEELWOOD BENCHES

HAMILTON Steelwood Benches are built for long life. The all-steel frame is electrically welded. The bench cannot break . . . and it cannot wear out. Study the details in the illustration above . . . they show why Steelwood Benches are the choice of instructors everywhere.

TYPICAL UNIT KITCHEN

The unit kitchen shown at the left consists of modern HAMILTON Kitchen Units. Units like these can be assembled to meet the needs of your Home Economics Department. All of the HAMILTON Unit Kitchen Equipment is made of both Steelwood and Steel construction to the high standard of all HAMILTON Equipment.



V-1302

SINK CABINET ASSEMBLY

Unit kitchen sink cabinet assembly No. V-1302 shown at the left is just one of the many possible combinations.

This new catalog will give you first-hand information on the latest improvements in school furniture. Write for your copy today!

HAVE YOU RECEIVED A COPY OF OUR NEW CATALOG?

These new designs and many others covering the complete equipment for Industrial Arts, Domestic Science, Commercial and Laboratory Departments . . . are fully described in the new HAMILTON Catalog No. 200. It's just off the press . . . 192 pages of information you want to have on file. Send in the coupon for your copy today.

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TWO RIVERS, WISCONSIN

Please send me your new Laboratory Furniture Catalog.

Name_____

Address_____

City_____ State_____

(Continued from page 10A)

Gouges
- *a*) Tanged-firmer, outside ground, handled, ⅛ in., ¼ in., ½ in., ¾ in., 1 in.
- *b*) Tanged-firmer, inside ground, handled, ⅛ in., ¼ in., ½ in., ¾ in., 1 in.
- *c*) Spoon, ½ in., ¾ in., and 1 in.

Hammers — claw, bell-faced, 10-oz., 12-oz., 13-oz., 16-oz

Hatchet — bench, 4 in. cut

Jars — earthenware, 1-qt. capacity

Knives
- *a*) Jointer, to fit power machine
- *b*) Planer, to fit power machine
- *c*) Sloyd, 3 in. blade

Levels
- *a*) Wood, 24 in.
- *b*) Machinists', 12 in.

Mallets — hickory, 3 in. by 5 in. head

Nail Sets — 1/16 in. and 3/32 in. points

Oilers — bench, 1/3-pt. coppered, best grade

Oilstones
- *a*) 1 in. x 2 in. x 8 in. in iron box
- *b*) Gouge slip, medium, 4½ in. x 2⅝ in. x 5/16 in. x 5/16 in.
- *c*) Gouge slip, fine, 3 in. x 2 in. x ⅜ in. x ⅛ in.

Pincers — 6 in. carpenters'

Pinch Dogs — ¾ in., 1 in., and 1¼ in.

Planes
- *a*) Block, adjustable, 6 in. long, 1⅝ in. cutter
- *b*) Circular
- *c*) Combination, adjustable
- *d*) Core box
- *e*) Duplex, fillister and rabbet
- *f*) Fore, ⅛ in., 2⅜ in. cutter
- *g*) Irons, double
- *h*) Jack, 14 in., 2 in. cutter
- *j*) Jointer, 24 in.
- *k*) Round, wood, 1¾ in.
- *l*) Router
- *m*) Smooth, 9 in., 1¾ in. or 2 in. cutter

Pliers
- *a*) Round-nose, 5 in.
- *b*) Side-cutting, 6 in.

Putty Knives

Rasps — half round, wood, 10 in.

Rules
- *a*) Board
- *b*) 1 ft. or 2 ft. graduated by 8ths and 16ths
- *c*) Shrink, ⅛ in., 3/16 in.

Saws
- *a*) Back, 12 in., 14-point
- *b*) Band, ¼ in., ½ in., ¾ in., to fit power machine
- *c*) Compass, 10 in.
- *d*) Coping, frames
- *e*) Coping, blades
- *f*) Crosscut, 9-tooth, 22 in. long
- *g*) Crosscut, circular for power machine
- *h*) Dado, ⅛ in. to 1 1/16 in. to fit power-saw arbor
- *j*) Hack, frames, 8 in. or adjustable
- *k*) Hack, blades, 8 in.
- *l*) Keyhole, 10 in., 10-point
- *m*) Rip, 7-point, 22 in. long
- *n*) Rip, circular for power machine
- *o*) Set, 10 points per inch and finer
- *p*) Set, 10 points per inch and coarser
- *q*) Turning frame, 14 in.
- *r*) Turning blades, 3/16 in. x 12 in., 10-tooth
- *s*) Miter-box, 24 in. x 4 in. saw, 7 in. capacity at miter

Scrapers
- *a*) Cabinet
- *b*) Glue, triangular
- *c*) Veneer, blade 2¾ in. long, handle 11 in. long

Screw Drivers
- *a*) Cabinetmakers', 4 in., 6 in., and 8 in.
- *b*) Quick-return, spiral ratchet

Shoot Board — and plane

Snips — tinners', forged steel, 2½ in. cut

Spokeshaves — adjustable, raised handle, 10 in. long

Squares
- *a*) Combination, 12 in.
- *b*) Try-, iron handle, 8 in.
- *c*) Framing, 2 ft.

Steel Figures — hand cut, ⅛ in.

Tapeline — 50 ft. steel

Trammel Points — adjustable metal frame, steel points

Turning Tools (for 12 lathes)
- *a*) Calipers, 6 in. inside and outside
- *b*) Calipers, 12 in. inside and outside
- *c*) Parting tools, ⅛ in.
- *d*) Round point, ¼ in., ½ in., ¾ in.
- *e*) Spear point, ¼ in., ½ in., ¾ in.
- *f*) Square point, ¼ in., ½ in., ¾ in.
- *g*) Turning chisels, ¼ in., ½ in., ¾ in.
- *h*) Turning gouges, ¼ in., ½ in., ¾ in.
- *j*) Turning skews, L.H., ¼ in., ½ in., ¾ in.
- *k*) Turning skews, R.H., ¼ in., ½ in.

Vise — 3 in. jaw anvil face

Wrenches
- *a*) Adjustable, 8 in., 10 in., and 12 in.
- *b*) Headless setscrew, ¼ in. to ⅝ in. by 16ths
- *c*) Pipe, 10 in. and 12 in.
- *d*) S-type or open-end type to fit ⅛ in. to 1 in. U.S.S. nuts

Woodworking—Materials and Supplies

Alcohol

Benzine

Brads — ⅜ in., ½ in., and ⅝ in. No. 20; ¾ in. and ⅞ in. No. 10; 1 in. No. 18; 1¼ in., and 1½ in. No. 16; 1¾ in. No. 15; 2 in. and 2½ in. No. 14

Carbon Paper — black

Colors — dry: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, Van Dyke brown, and vermilion

Colors — ground, in oil or japan: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, rose lake, Van Dyke brown, and vermilion

Decalcomania Transfers

Dowel Pins and Plates

Dowels: hardwood, 3-ft. lengths, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.

Enamel
- *a*) Selected colors
- *b*) Undercoater

Fillers — paste: natural, golden oak, dark oak, and mahogany

Fillets — leather, ¼ in. and ½ in.

Glue
- *a*) Casein, hide, best grade cabinet
- *b*) Liquid

Hardware: Brackets, buttons, butts, casters, catches, chain, chest corners, chest trimmings, corner braces, corner irons, corner plates, desk fittings, door fittings, escutcheons, fasteners, handles, hangers, hinges, hasps, holders, hooks, knobs, latches, lamp fittings, lid supports, locks, pulls, smoking-stand outfits, springs, stops, supports

Hooks
- *a*) And eyes
- *b*) Cup
- *c*) Screw and
- *d*) Square screw

Lacquer — black, clear, cobalt blue, ivory, medium green, red, thinner, white and yellow

Lumber — Ash, balsa, bass, birch, cherry, cypress, locust, mahogany, maple, oak, poplar, red cedar, red gum, redwood, sap gum, yellow pine, walnut, white pine

In ordering pine, mill-run kiln-dried will be found suitable for carpentry, while short, select, kiln-dried 4 in. and wider or No. 1 shop common, kiln-dried will be required for cabinetmaking and patternmaking

Hardwood, for furniture, should be specified first and second grade, kiln-dried, standard widths and lengths, or short lengths

Moldings

Nails
- *a*) Common, 6d, 8d, and 10d
- *b*) Flat-head, ½ in. No. 20, ¾ in. No. 19, 1 in. No. 18, 1¼ in. and 1½ in. No. 16, and 2 in. No. 14
- *c*) Finishing, 4d, 6d, and 8d

Oil
- *a*) Linseed, boiled
- *b*) Linseed, raw
- *c*) Machine
- *d*) Rubbing

Overlay Carvings

Panel or Plywood — 3-ply, 5-ply, and 7-ply

Pattern Letters

Pins — escutcheon

Pumice Stone — No. 0

Rapping Plates

Rottenstone

Sandpaper — Garnet cabinet paper, 3/0, 2/0, 0, ½, 1 (running from fine to coarse)

Garnet finishing paper, 6/0, 4/0

Garnet paper can also be obtained in rolls of 50 yd. in widths 4 in. up to 48 in. Narrower widths on special order

Screw Eyes

Screws
- *a*) Flat-head, brass, No. 3 x ⅜ in., No. 4 x ½ in., No. 5 x ⅝ in., No. 5 x ¾ in., No. 6 x ¾ in., No. 8 x 1 in., No. 10 x 1¼ in., No. 10 x 1½ in., No. 12 x 1¼ in., No. 12 x 1¾ in., No. 10 x 2 in.
- *b*) Flat-head, bright, No. 3 x ½ in., No. 4 x ½ in., No. 6 x ¾ in., No. 8 x 1 in., No. 10 x 1 in., No. 10 x 1¼ in., No. 8 x 1¼ in., No. 14 x 1¼ in., No. 10 x 1½ in., No. 12 x 1½ in., No. 10 x 1¾ in., No. 12 x 1¾ in., No. 10 x 2 in., No. 12 x 2 in., No. 14 x 2 in., No. 12 x 2¼ in., No. 14 x 2¼ in., No. 14 x 2½ in.
- *c*) Oval-head, brass, No. 5 x ¾ in., and No. 10 x 1¼ in.
- *d*) Round-head, blued, No. 3 x ⅜ in., No. 3 x ½ in., No. 5 x ¾ in., No. 6 x ¾ in., No. 8 x 1 in., No. 10 x 1¼ in., No. 10 x 1½ in., No. 12 x 1½ in.
- *e*) Round-head, brass, No. 2 x ⅜ in., No. 3 x ⅜ in., No. 4 x ½ in., No. 3 x ⅝ in., No. 5 x ¾ in.

Shellac
- *a*) Orange, cut 4 lb. to the gal.
- *b*) Sticks, assorted colors
- *c*) White, cut 4 lb. to the gal.

Note: Shellac should be kept in glass or earthenware containers

Stains — oil, spirit or water: Fumed oak, dark oak, golden oak, light oak, mahogany, and walnut

Steel Wool — No. 0 and No. 00

Turpentine

Twine

Varnish — coach, flat, remover, spar, and rubbing

Waste — cotton, white

Wax — bees and finishing

White Lead

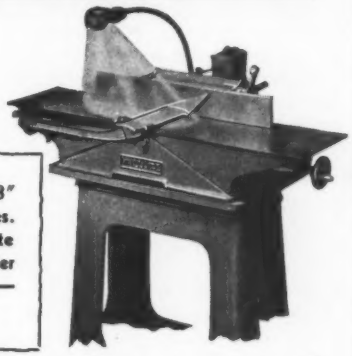
Industrial Tools for Practical Industrial Education!

TIME-TESTED, 25 YEARS IN 75,000 SHOPS

WALLACE
No. 8
UNIVERSAL SAW

Gear Drive. Micrometer Rip Fence. Hardened and Ground Steel Spindle. Two Cross-Cut Fences. Optional Guards for Complete Safety. Warpless Steel Tables.

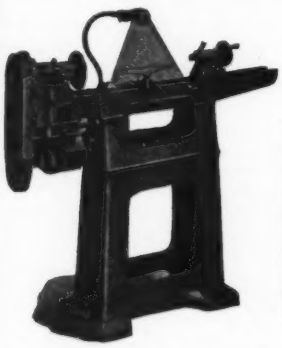
And 3" cutting capacity with just a 9" blade!



WALLACE
No. 10
JOINTER

Direct or Gear Drive. 8" Capacity. Semi-Steel Tables. Optional Guards for Complete Safety. Timken Taper Roller Bearings. Knives Set Askew—Take Whittling Cuts.

With four-knived head—14,400 cuts per minute!



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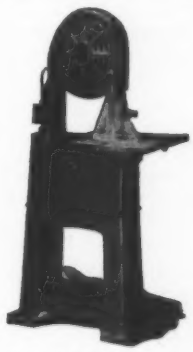
MULTI-SPEED LATHE

Automatic - Tensioning Belt Drive. Hardened and Ground Steel Spindle. Timken Taper Roller Bearings. Nine Speeds from 550 to 2400 r.p.m. Face Plate Work to 30" diameter.

A favorite lathe for metal-spinning work!



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16" Dynamically Balanced Steel Wheels. Warpless Steel Table—Swivels for Ripping Work. Ball bearing Guides. Cast Iron Frame and Stand. Built-in Electric Light.

Gear drive. 1100 r.p.m. 4600 ft. of blade per min.

WALLACE
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OILSTONE GRINDER

Gear Drive. Reduces Wheel Speed to 500 r.p.m. Can't burn tools. Automatic Coolant Feed. Coarse and Fine Cup Wheels. High Speed Cone Wheel. Dry Grinding Wheel. Tilting Table.

Slow speed. Throws no sparks—breaks no wheels!

WALLACE
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SHAPER

Direct Drive. 8500 r.p.m. ⅝" Dia. Hardened and Ground Steel Spindle. Takes Knives, Cutters, and Routing and Shaping Bits. 20" x 30" Table. Cast iron stand.

Eliminates sanding. Cuts smooth on end grain!

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CHICAGO, ILL.

(Continued from page 136)

Industrial Hygiene

The foregoing list of occupational diseases brings to one's mind the old saying that "to be forewarned is to be forearmed." This is as true of man's occupation today as it was in the olden days when other types of enemies surrounded him on all sides, and with whom for the sake of his very existence he was constantly at war. Industrial hazards today cover all types of dangers to health, life, and limb. The shop teacher usually stresses safety to life and limb when using machinery; the related science should stress the other dangers apart from machines which face men in industry today. They must be taught to recognize these harmful agents to which a worker is exposed as the result of an ever increasing number of industrial processes with their poisonous fumes, dusts, and high temperatures in which the worker must carry on his occupation. This teaching to avoid the health hazards of modern industry has a very important place in our industrial science courses. Looking back over my own industrial experiences I can recall many instances where knowledge of occupational diseases would have saved men from serious illness and in one case — death. Doubtless there were many more cases which were not recognized as diseases resulting from materials being used or from conditions under which the work was being done.

During the past two decades there has been a great increase in the number of poisonous substances used in industry. The so-called "chemical industries," the production of coal-tar by-products, and the rapidly growing plastic industries, all these have made their contributions to the growth. Lead, one of the most widely used of our industrial metals today, might be listed as the worker's "Public Enemy No. 1." This metal causes more ill health than any of the other poisonous fumes, dusts, or solids. In discussing this with a class the other day, one of the boys — an apprentice printer — said, "I'm so glad we talked about lead poisoning. I've had the habit for a long time of putting type in my mouth. It is a convenient way of holding it. I know better now."

The following extract is from U. S. Department of Labor, Bulletin No. 582. All related-science teachers should read this bulletin, if they have not already done so. It is an eye opener on this matter of occupational diseases. "Lead poisoning has reached plague-like proportions in its intensity and extent in the automobile industry. The exact number of workers affected by this disease is not known. . . . Lead and its compounds are used in over a hundred trades and in many kinds of work associated with the construction of automobiles. In the finishing of bodies, the imperfections are filled in with a lead solder and the subsequent grinding down of these filled imperfections creates a fine lead dust in the atmosphere. This fine dust is absorbed by breathing and from the lungs it is carried through the blood stream and deposited in the bones. When the lead is quickly absorbed it gives rise to various symptoms which warn the patient of his danger. But if the lead is slowly absorbed, the body is filled up with lead before the warning signals are given. This individual is usually incurable. . . ." The U. S. Dept. of Labor lists over 100 different occupations in which there is exposure to lead poisoning, the following being examples: Battery makers, brass workers, electroplaters, filers, garage workers, grinders, plumbers, polishers, painters, solderers, typesetters, metal finishers, and body finishers.

Skin diseases constitute another health hazard especially among machinists who are likely to develop infectious sores from sharp particles of steel, dirty oil, and liquids used to cool the cutting surfaces on work in high-speed machine tools. These poisonous substances may reach abrasions in the skin and set up irritations and septic poisoning. Any individual may guard himself, to a great extent, against these dangers if aware of their existence and given the necessary help in the shape of materials and conveniences. Students should be taught the necessity for strict attention to personal cleanliness and health.

Frequent bathing and the scrubbing of the hands before touching any food should be stressed. Also the essential proper diet and food habits, and protection afforded by proper clothing in the shape of gloves and coveralls. Medical examinations at periodic intervals are essential for those engaged in the most dangerous industrial processes.

The Courses Outlined

In the usual type of school, chemistry and physics are highly segregated and like east and west "never the twain shall meet," at least not in school. In the industrial science laboratory these two branches of science should be so completely integrated that their separate identity is lost. In the study of steel, for instance, (*a*) the heat treatment of steel, (*b*) the crude analysis of steel by spark test, and (*c*) the effects of acids and alkalis on steel, become parts of the same study unit. In the development of trade and industrial courses this thought should be kept in mind. Where we already have school buildings equipped with separate laboratories in the traditional manner we have to modify our related work to suit. In this case the shop often can be made to serve the place of a laboratory and experiments may be carried out as shop projects under the most practical conditions.

With these thoughts and considerations in mind the following courses in related industrial science were, and are still being, evolved.

Industrial Science 1

(General Industrial Chemistry)

I. Purposes

A. To familiarize the boy who is to enter the auto-mechanics, building, metalworking or printing trades with those materials which he is most apt to encounter upon entering employment.

B. To prepare him for further study of industrial materials and processes.

C. To acquaint him with dangers to health from certain industrial chemicals, improper foodstuffs, drugs, and narcotics.

II. Subject Matter

A. Chemical changes
1. Method of teaching:
   a) Class discussion.
   b) Demonstration.
   c) Laboratory work.
2. Text and references:
   a) *Chemistry*,[1] Chapters 2 and 8.
   b) *Chemistry in Industry*,[2] "Explosives," "Asbestos."
3. Suggested problems and experiments:
   a) Experiments Nos. 1–11, 61–68, from *Chemistry*.
4. Facts to be learned:
   a) The meaning of chemical change.
   b) The detection of chemical change.
   c) The process of combustion.
5. Abilities to be developed:
   a) To read with understanding.
   b) To take notes from references read.
   c) To use simple laboratory equipment.

B. Oxygen and its conduct
1. Method of teaching:
   a) The use of slides or motion pictures is added to the methods outlined in Section A.
2. Text and references:
   a) *Chemistry*, Chapters 1 and 5.
   b) *Chemistry in Industry*, "Catalysts," "Rustproof metals."
   c) A miscellaneous file of pamphlets, catalogs, bulletins.
3. Suggested problems and experiments:
   a) Experiments from *Chemistry*.
4. Facts to be learned:
   a) Oxygen and the process of corrosion.
   b) Sources of oxygen.
   c) The prevention of oxidation.
5. Abilities to be developed:
   a) Further skill in the abilities listed under A.

C. Water
1. Method of teaching:
   a) Inspection trips to the city pumping plant, water-softening plant, or sewage-disposal plant is suggested as an additional method.
2. Text and references:
   a) *Chemistry*, Chapters 3 and 17.
   b) *Chemistry in Industry*, "Water."
   c) Instruction sheets on water softening and conditioning.
3. Suggested problems and experiments:
   a) Experiments from *Chemistry*, Nos. 15–31, 86–89, 105–107.
   b) Special lesson sheets on water softening and testing.
4. Facts to be learned:
   a) How water acts as a solvent.
   b) What water must not contain to be healthful.
   c) How boiler scale is caused and prevented.
   d) How water aids chemical reactions.
5. Abilities to be developed:
   a) To use chemical facts in interpreting happenings in everyday life.

(Continued on page 16A)

[1]Greer and Bennett, Allyn and Bacon, New York City.
[2]Howe, Chemical Foundation, New York City.

The Carborundum Company

(Reg. U. S. Patent Office)

Niagara Falls, N. Y.

Manufacturers of

Abrasive Products for School Shop Work

Abrasives play an all-important part in school shop work. It is particularly desirable that the shops be completely equipped with fast, clean-cutting, durable sharpening stones, grinding wheels, and abrasive paper and cloth to meet all abrasive needs. The Carborundum Company has always made a feature of supplying abrasive products exactly suited to the conditions of the school shop.

Carborundum Brand Combination Stones

For sharpening chisels, plane bits, scraper knives and similar edge tools, these combination stones are recommended. One side is in coarse grit to take out nicks and to bring the tool to an edge; the other side, fine grit to impart the keen, smooth edge. Made in seven sizes.

No. 108—8 x 2 x 1 inches.
No. 109—6 x 2 x 1 inches.
No. 110—7 x 2 x 1 inches.
No. 111—5 x 2 x ¾ inches.
No. 112—4 x 1¾ x ⅜ inches.
No. 328—8 x 3 x 1 inches.

Write for Catalog A 599

Carborundum Brand Sharpening Stones

Carborundum Brand Sharpening Stones are also made in the solid grit — that is, the same grit all through. These can be used for exactly the same purposes as are the combination stones. They also cut clean and fast, show long life, wear evenly. Like the combination stones, they can be used dry or with oil. Made in fine, medium, or coarse grit.

No. 115—Fine.....8 x 2 x 1 inches
No. 116—Medium....8 x 2 x 1 inches
No. 117—Coarse.....8 x 2 x 1 inches
No. 121—Fine.....6 x 2 x 1 inches
No. 122—Medium....6 x 2 x 1 inches
No. 123—Coarse.....6 x 2 x 1 inches

Write for Catalog A 599

Special Carborundum Brand Stones are also made for truing and sharpening of automatic planer knives. For sizes, etc., see catalog A 599.

Carborundum Brand Extra Hard, Extra Fine Stones

For giving a finer, smoother edge to woodworking and carving tools, these extra fine, extra hard stones have been developed. These include a special manual training slip stone for sharpening gouges, etc.

No. 155 Slip—4½ x 1¾ x ½–⅝ inches
No. 156—8 x 2 x 1 inches
No. 158—6 x 2 x 1 inches

Carborundum and Aloxite Brand Grinding Wheels

Reg. U. S. Pat. Off.

Getting the right wheel in the right place is one of the first principles of grinding. For the grinding of materials of low tensile strength, such as brass, bronze, cast iron, etc., Carborundum Brand Silicon Carbide Wheels are recommended. For the grinding of high tensile strength materials, such as steels and alloys. Aloxite Brand Aluminum Oxide Wheels should be used. These wheels are made in all necessary sizes, grits, and grades to meet all grinding conditions.

Write for Catalog A 852

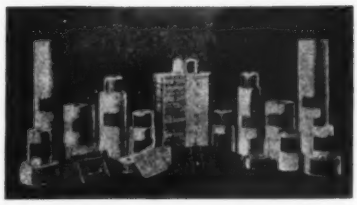
Carborundum Brand Coated Abrasives

The Carborundum Company is one of the leaders among the manufacturers of abrasive paper and cloth. These products include Carborundum Brand Garnet and Flint Papers for the finishing of all woods, and Aloxite Brand Cloth for the finishing of metals.

Write for Catalog A 672

Carborundum Brand Garnet Paper

Where a paper coated with a harder abrasive for use on the harder woods or in cases where a more careful finish is desired, Carborundum Brand Garnet Paper should be used. Uniformly coated with accurately graded North River Garnet. Strong, durable yet flexible backing. Cuts free and clean. Supplied in 9 x 11 inch sheets, reams, and in standard rolls in standard grits.

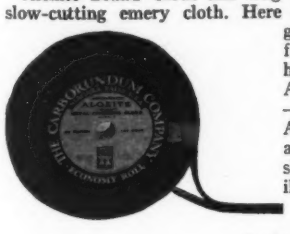


Carborundum Brand Flint Paper

On ordinary run of sanding, particularly on softer woods, Flint Paper can be effectively used. Carborundum Brand is uniformly coated with uniformly graded superior flints. It cuts clean, it's durable. Furnished in Handi-pac cartons, assorted grits or standard ream bundles.

Aloxite Brand Cloth

Aloxite Brand Cloth has long ago taken the place of the old slow-cutting emery cloth. Here is a cloth that cuts with far greater speed, leaves a more uniform finish. It is coated with the hard, sharp, tough grains of Aloxite Brand aluminum oxide — a manufactured abrasive. Aloxite Cloth is put up in standard ream packages 9 x 11 inch sheets or in economy rolls — see illustration.



For Your Information

Any of the publications listed here are available on request.

A wealth of information on various phases of the use of abrasives that belongs in your library.

	Form No.
Romance of Carborundum	A-111
Abrasives in the Service of Industry	A-617
Grinding Wheel Specifications for Grinding Machines	A-745
Carborundum and Aloxite Brand Grinding Wheels	A-852
Wheel Grading Booklet	A-582
A Treatise on Dressing and Truing of Grinding Wheels	A-818
Grinding Cemented Carbide with Green Grit Wheels	A-742
Diamond Wheels for Sharpening, Conditioning and Lapping Hard Cemented Carbide	A-894
A Treatise on Tool Room Grinding	A-848
Mounted Wheels for Portable and Internal Grinding	A-766
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Gradings — Tool Room Wheels	A-926

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(Continued from page 14A)

b) To understand more clearly those shop processes which depend upon the properties of water.

D. Acids and alkalis

1. Method of teaching:
   a) Class discussion.
   b) Laboratory work.
   c) Demonstrations.
2. Text and references:
   a) *Chemistry,* Chapters 9, 10, 24, 27.
   b) *Chemistry in Industry,* "Batteries," "Refrigeration."
   c) *Materials of Industry,*[3] "Mortar."
   d) Instruction sheets relating to industrial hazards.
3. Suggested problems and experiments:
   a) Experiments from *Chemistry,* Nos. 61–76, 138–141, 163–166.
   b) Tool marking by etching.
   c) Cleaning and pickling of metals.
4. Facts to be learned:
   a) Litmus tests for acids and alkalis.
   b) Effect of specific acids and alkalis on metals, paints, fabrics, and skin.
   c) How to neutralize the effects of acids or alkalis.
   d) Health hazards and fire hazards in the use of these substances.
5. Abilities to be developed:
   a) To safely handle acids and alkalis.
   b) To use more advanced laboratory techniques.

E. Fuels — Natural and artificial fuel gases, petroleum products, coal products.

1. Method:
   a) All the previously mentioned methods are used in this unit.
2. Text and references:
   a) *Chemistry,* Chapters 16, 18, 20, 21 (alcohol).
   b) "Coal," "Petroleum," "Alcohol" in *Chemistry in Industry* and *Materials of Industry.*
3. Suggested problems and experiments:
   a) Experiments from text Nos. 99–100, 109–111, 117–120.
   b) Distillation of crude oil.
4. Facts to be learned:
   a) How to fire furnaces with solid fuels.
   b) Meaning of BTU, Octane rating.
   c) Effect of sulphur in fuels.
   d) Relative cost, advantages and disadvantages of various typical fuels.
   e) How to adjust gas burners.
   f) How acetylene is produced and stored.
5. Abilities to be developed:
   a) To properly fire a home furnace.
   b) To intelligently appraise advertising relating to fuels.
   c) To keep safety in mind when using dangerous fuels.

F. Common industrial materials including: cellulose, rubber, carbon, portland cement, building stones, tile and brick, abrasives, synthetic resins, metals. This list is varied depending upon available time and the trade interests of the class.

1. Method of teaching:
   a) Reading and note taking from special references so as to permit each boy to study the topics most closely related to his trade.
   b) Class discussion.
   c) Laboratory work.
   d) Slide and motion pictures, especially the latter if funds are available for express charges.
   e) Inspection trips.
2. Text and references:
   a) *Chemistry.* Use index for topics desired.
   b) *Chemistry in Industry.* Select chapters which are appropriate.
   c) *Materials of Industry.* Select portions desired.
   d) Filed pamphlets.
   e) Books and magazines in the library.
3. Suggested problems and experiments:
   a) Experiments may be selected from those parts of *Chemistry* used.
   b) A paper, relating to some material used in the boy's trade, or in the industrial-arts course which he is engaged in, may be written. The writing can be carried on as a part of the written work in industrial English.
   c) An exhibit box, showing the preparation and use of some such material can be prepared by each pupil.
4. Facts to be learned:
   a) The boy should be familiar with the properties and uses of those materials studied which are used in his trade or industrial-arts course.
5. Abilities to be developed:
   a) To be able to find information in the library.
   b) To read with understanding.
   c) To apply his knowledge to shop problems.

III. Equipment

A. A room with demonstration bench and storage space for needed chemicals and equipment.

B. Projectors for showing slides and motion pictures.

C. Means for darkening room.

D. Vertical file for pamphlets, lesson sheets, etc.

E. Laboratory with usual chemical type benches, fume hoods, storage cases, etc.

F. Chemicals and equipment are listed in the inventory.

IV. General Method

This course differs from the college-preparatory course in that emphasis is on the properties and uses of materials rather than elements and their chemical conduct. Enough theory is introduced to aid the boy in understanding chemical changes. No quantitative work is done in this semester. An attempt is made to enlarge the reading done by the pupil in technical books and magazines.

V. Time Allotment

A. Five hours a week for nineteen weeks.

B. Two hours a week are devoted to laboratory work or inspection trips.

[3]Mersereau, McGraw-Hill Book Co., New York City.

Industrial Science 4

(Automotive)

I. Purpose

A. To provide the technical background necessary for an understanding of automotive shop processes which depend upon the chemical and physical properties of such materials as are used therein.

B. To give such information as will lessen the chances of personal injury from industrial hazards.

II. Subject Matter

A. A general survey of the metals used in the automotive industry, particularly those used locally.

1. The following methods of teaching are to be used:
   a) Reading.
   b) Discussion.
   c) Notebooks.
   d) Sketching.
   e) Posters, and motion pictures if funds are available for express charges.
2. Text and references:
   a) *Chemistry.*
   b) *Machinery Handbook.*[4]
   c) A collection of pamphlets, catalogs, etc., relating to metalwork in the automotive field.
3. Suggested jobs, applications, and experiments:
   a) Lesson sheets are provided covering the laboratory work.
4. Facts to be learned:
   a) The chemical and physical properties of the metals and alloys used in this industry.
   b) Processes whereby these metals and their alloys are prepared and used.
5. Abilities to be developed:
   a) To recognize many of the metals and their alloys by their properties and simple tests.
   b) To intelligently use these metals when required in their work.

B. A general survey of the oils and fuels used in the automotive field.

1. Methods of teaching. These are the same as used in A.
2. Text and reference:
   a) *Chemistry.*
   b) *Chemistry in Industry,* Vols. I and II.
   c) Pamphlets and catalogs, etc., relating to the preparation and uses of oils in the automotive field.
3. Suggested jobs, applications, and experiments:
   a) Experiments in the text.
   b) Lesson sheets covering special experiments.
4. Facts to be learned:
   a) The process of carburetion, explosion, and exhaust in types of internal-combustion engines used in the automotive industry.
   b) The properties and limitations of various lubricating oils.
5. Abilities to be developed:
   a) To recognize the fuels used in their work and apply simple tests to determine their qualities.
   b) To apply the knowledge of carburetion to repair and maintenance work on the internal-combustion engine.

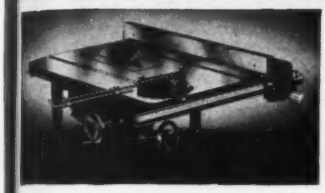
C. The use of oxygen and acetylene in the automotive industry.

1. Method of teaching:
   a) In addition to the methods cited in A and B a series of correlated shop projects is carried out in order to give some experience in the use of the oxyacetylene torch.
2. Text and references:
   a) *Chemistry.*
   b) *Oxwelder's Manual.*[5]
   c) Various pamphlets, catalogs, etc., including *Safe Practice Bulletin No. 23*[6] and regulations of the

(Continued on page 19A)

[4]Industrial Press, New York City.
[5]Linde Air Products Co., New York City.
[6]National Safety Council, Chicago, Ill.

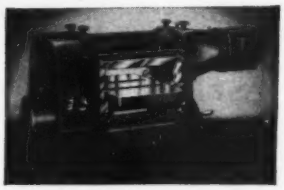
BOICE-CRANE *shop-tested* POWER TOOLS *for* Programs-Equipment Abreast of Industrial Trends



THE FIRST Boice-Crane machines built 28 years ago exploded the belief of industrial woodworkers that only big, expensive machines were efficient enough for commercial work. BOICE-CRANE — pioneer and leader in its field sells industry larger numbers of its machines each year. Now—alert educators are following industry's example, finding too that BOICE-CRANE leads in desirable modern improvements, super-safety, and a never equalled quality that keeps BOICE-CRANE machines running for many *extra* years.

NEW! Tilting-Arbor Saw

Again in 1939 BOICE-CRANE leads in Tilting-Arbor Saws. 9 years ago BOICE-CRANE was the first tool builder to introduce this better kind of saw to the medium price field. Widely imitated since, but the exclusive, fool-proof, BOICE-CRANE Rolling Pulley Drive has never been equalled! All the power you want up to 1½ h. p. at a big saving! Now has a new, finer Rip Fence never offered before in any saw!



12"x4" THICKNESS PLANER

Large enough to handle ninety-nine of every hundred jobs of planing in school shops. Saves floor space. Priced low for modest shop budgets. Don't be without a planer another term!

Planes hardest cabinet woods so smooth no sanding is necessary! Built like expensive cabinet planers. Belt and direct motor drives, bench or floor types. *Get full details!*

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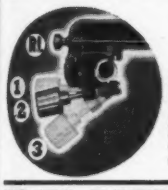
METAL SPINNING TOOLS

We make lathes, also tools and accessories for Metal Spinning. *Get our catalog.*

Ask for FREE Book on Metal Spinning

New HELMET-HEAD Safety Drill Press

The first *super-safe* Drill Press at a low price. Meets all regulations on guarding. You'll be surprised how little more this much heavier-duty Drill costs. Will last years longer. For your heaviest boring (wood-metal), routing, mortising, and shaping. Larger head; bigger quill; bearings practically twice as large as others use. Longer quill housing reduces drill breakage, prevents drills and mortising chisels from "leading". For the wood, machine, general and farm shop.



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Quicker, easier, "split-hair" settings at the first try *every time*. No gears. One control handle does it all!

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UP-TO DATE TOOLS FOR TODAY'S INDUSTRIAL TRAINING

(Continued from page 16A)

National Board of Fire Underwriters.

3. Suggested jobs, applications, and experiments:
   a) Experiments in the text.
   b) Lesson sheets covering special experiments.
   c) Selected jobs as outlined in *Training Course for Aircraft Welders* as far as present equipment will permit.
4. Facts to be learned:
   a) The fundamental principles, development and industrial importance of the oxyacetylene process for welding, brazing, and cutting metals.
   b) Precautions and safe practices in the use of oxyacetylene equipment.
   c) The Schafer method, and other methods of artificial respiration used in cases of asphyxiation and other accidents where oxygen is used for the purpose of resuscitation.
5. Abilities to be developed:
   a) To handle oxyacetylene equipment in accordance with the best practices used in industry.
   b) To become familiar with many phases of procedure control as well as with actual factory operations and technical features of construction in the automotive field.

D. A general survey of the lacquers, paints, and varnishes used in the automotive industry.

1. The following methods of teaching are to be used:
   a) Reading.
   b) Discussion.
   c) Notebooks.
   d) Posters.
   e) Laboratory work.
2. Text and references:
   a) *Chemistry.*
   b) *Chemistry in Industry.*
   c) Pamphlets, catalogs, etc.
3. Suggested jobs, applications, and experiments:
   a) Lesson sheets are provided covering the laboratory work.
4. Facts to be learned:
   a) The chemical and physical properties of lacquers, paints, and varnishes.
   b) Their uses in the automotive field.
5. Abilities to be developed:
   a) To recognize many of the lacquers, paints, and varnishes by their properties and by simple tests.
   b) To use intelligently these liquids when required in their work.

E. A general study of miscellaneous materials used in the automotive industry.

1. Methods of teaching. These are the same as in unit D, with the addition of motion pictures and slides if funds are available for express charges.
2. Text and references:
   a) *Chemistry.*
   b) *Chemistry in Industry.*
   c) Pamphlets, catalogs, etc.
3. Suggested jobs, applications, and experiments:
   a) Experiments in the text.
   b) Lesson sheets covering special experiments.
4. Facts to be learned:
   a) The boy should be familiar with the properties and uses of these materials.
5. Abilities to be developed:
   a) To use intelligently these materials in actual work.

III. Equipment

A. A room for lecture purpose.

B. Projectors for showing slides and motion pictures.

C. Vertical file for pamphlets, lesson sheets, etc.

D. Laboratory with usual chemical-type benches, fume hoods, storage space, and stock room.

E. Chemicals and equipment as listed in the inventory.

F. Oxyacetylene welding and cutting equipment in the school shop.

IV. General Method

Special emphasis is placed on the practical use of the materials being studied together with the properties which make them useful. The application of theory to practical work is also stressed and as many trade problems are introduced as is possible within the limitations of equipment and material available. The keeping of shop notebooks, in which sketching plays a big part, and the reading of technical and trade magazines and books are encouraged.

V. Time Allotments

A. Five hours a week for nineteen weeks.

B. Two hours a week are spent in laboratory work or on inspection trips.

(Continued on page 20A)

A MAN CAN DO ANYTHING IF HE HAS THE TOOLS AND KNOWS HOW

With your instruction and Starrett Tools, your classes will go a long way.

STARRETT CATALOG 26 CE
illustrates and describes a complete line of Starrett Tools and Hacksaws for school and shop classes.

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show how to use the essential precision tools. Fourteen 8 x 10½ blue-printed pages punched to fit a standard notebook. Furnished at cost, 10 cents per set.

THE L. S. STARRETT CO., ATHOL, MASS., U. S. A.
World's Greatest Toolmakers — Manufacturers of Hacksaws Unexcelled — Steel Tapes, Standard for Accuracy Dial Indicators for Every Requirement

(Continued from page 19A)

Text

It must be obvious that no suitable text has as yet been written to cover a course in related industrial science to fit all conditions and localities. The instructor must usually choose some book or books covering chemistry, in a very general way, and use this mainly as a reference. Lesson sheets must then be prepared to suit the kinds of industrial establishments and trades in the locality. In the city where this course is being given the majority of the students are working in, or are preparing to enter, the automotive industry. The book we have used as a text — and are still using as a main reference — is *Chemistry* by Greer and Bennett. This covers the field of chemistry in a very comprehensive and general way. A textbook to suit the trades being taught is being evolved from the notebooks and reference material collected from semester to semester. Each class is making contributions to this material so that in time a very comprehensive amount of information concerning local industries will have been built up.

In the work of the first semester, Industrial Science I, the students are working in, or preparing for, more diversified occupations than in the more special trade group of Industrial Science 4. In order to relate the science studies more closely to the student's vocation a 2500-word essay is required. This will describe some industrial process or description of material and its use in the boy's trade. The essay forms a major part of the work in the science class. Requirements of the English class are co-ordinated with it, and all outside reading is in connection with some topic pertaining to the subject of this essay. A brief outline of the requirements is given below.

1. The length of the essay to be no less than 2,500 words. This may include the descriptive writing accompanying the sketches and other illustrations.

2. It must be presented in book form and contain a bibliography.

3. When possible it must be accompanied by an exhibit of materials mounted on thick cardboard of standard size. This may be used later as illustrative material in the lecture room. The exhibit may also be mounted in a box of standard size made according to a blueprint supplied by the instructor.

A few of the essay projects which may be chosen by the students in different trades are listed below.

Builders (This group includes boys employed in, or preparing for, the sheet-metal, plumbing, painting, and carpenter trades)
1. Water softening.
2. Steel and concrete.
3. Paints and varnishes.
4. Synthetic woods and resins.

Auto mechanics and aeromechanics
1. Metals used in the airplane.
2. Rubber.
3. Antiknock fuels.
4. Petroleum products.

Printers
1. Paper.
2. Inks.
3. Electrotyping and engraving.
4. Photoengraving.

Electricians
1. Batteries.
2. Electroplating.
3. Insulators.
4. Industrial hazards.

Machinists and Draftsmen
1. High-speed and other steels.
2. Nonferrous alloys.
3. Occupational diseases.
4. Blueprints.

Notebooks

The scrapbook and the sketchbook are great teaching and learning aids which hold an appeal for the type of students found in the industrial courses. Neither of the two have as yet utilized these to the fullest extent. Many of the boys taking these courses are largely motor-minded and visual-minded. The more they can do with their hands or see with their eyes the better they like the work, and the instructor will have less disciplinary problems on this account. The lecture periods should be cut down as much as possible. It is remarkable how some students will literally "dig into" all kinds of trade and scientific periodicals in order to find material to fill a glorified scrap-note-sketch book. The following is a typical table of contents of such a book made by the average student in this course.

(Continued on page 22A)

Huther Bros. Saw Mfg. Co.

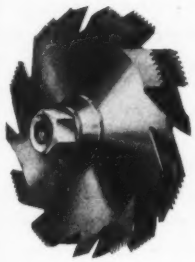
1290 University Ave., Rochester, N. Y.

Manufacturers of

Circular Saws, Groovers, Band Saws

Huther Bros. Saws are the result of more than sixty years' successful and uninterrupted experience in the manufacturing of saws. Each saw embodies the highest type of workmanship and is backed by a guarantee to be as free from flaws and seams as possible. Complete catalog on request.

Dado Head



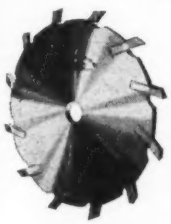
Our dado head developed from our own patents cuts grooves with or across grain, smooth, sharp sides, grooves from ⅛" up to 4" and over. Easily adjustable. Consists of 2 outside Cutters ⅛" thick and inside cutters to make desired cut. Inside cutters in 1/16", ⅛" and ¼" thicknesses. These Groovers make a perfect cut and leave the bottom smooth.

High Speed Knives

Shaper Stock, Ground Flat Stock

We manufacture thin High Speed Steel Knives, Solid Moulder Knives from High Speed Steel or Special Laid Steel. We can also furnish ground stock in various thicknesses and widths, square edges, in High Speed or best quality Tool Steel.

Inserted Tooth Groover



This is the perfect Groover for end grain cuts in hard wood. Teeth are High Speed Steel, front to back clearance, and require grinding on top only. Cuts full width groove through life of teeth. Teeth can be replaced.

Saw Vise

Setting Stake

These are useful articles for the filing room and were both developed for use in our own filing department. Vise is easily adjusted for various bevel filing and takes saws up to 18" diameter.

Angular Hub Groover

(New Patent No. 1782507)

This Groover was designed to cut end grooves in hard wood and to clear itself easily without swage or set. Clearance is effected by angular grinding of hub. Light adjustment. Used on regular saw mandrel without extra collars.

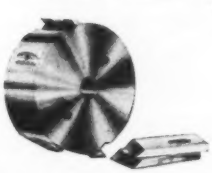
Band Saws

We make both wood and metal cutting band saws, also special temper saws for fibre, bakelite and soft metals. Let us know what you cut and we can furnish a saw for the purpose.

New Steady Rim Rip

This is an extra smooth cutting Rip Saw designed for smooth cutting at fast feed. This is the smoothest cutting Rip Saw we have and is capable of beautiful work.

Cutter Heads for Saw Mandrel



Cutter Heads for use on saw table. These heads can be furnished with variety of knives and used for jointing and running light moulding on saw table. Made in 6" diameter, 2¼" wide. Can be counterbored if necessary.

Mitre Saws

Our Mitre Saws are accurately ground with the proper side clearance and are made in six styles of tooth shape. Cleaner Tooth Saws are for both rip and cross-cut—made in diameters from 4" to 24".

CLAMPS

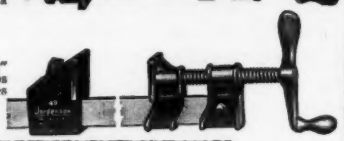
by "Jorgensen" TRADE MARK REG U S PAT OFF

Jorgensen Handscrews and Clamps are the standard clamps of industry and schools. Incorporated in each is an excellence developed through more than 35 years of specialization in CLAMPS. You will find them superior in design, and materials—stronger and handier in use. Buy them with confidence—there are no finer clamps made.

"Jorgensen" Handscrews grip at any angle. Will not split, or spring. Handles never loosen. Nuts will not jam.

"Jorgensen" HIGH-SPEED Steel Bar Clamps
have patented Multi-Disc Clutches that "zipp" to position, grip at any point on the bar. Many types. Plain crank type handles available, if specified, at no extra cost. (Not shown).

Pony Clamp Fittings
Pony fittings go on ordinary ¾" or ½" pipe—make strong, light, economical clamps of any length. Single and double bar types with multi-disc clutches.



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Pony Miniature "C" Clamps
9 types. Real tools in miniature, malleable frames and steel screws with free turning swivels.

The "Adjustable" line includes clamps and handscrews of over 40 types, in all sizes. Clamps not described above include: "Jorgensen" Drop Forged "C" Clamps. MARK Malleable Iron "C" Clamps.
Pony Malleable "C" Clamps, wood bar clamps and fixtures, welders clamps, etc., etc.

Write for Free Catalog

ADJUSTABLE CLAMP CO., *"The Clamp Folks"*
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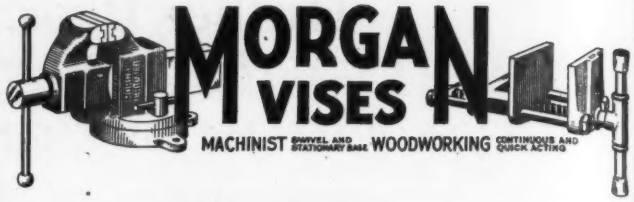
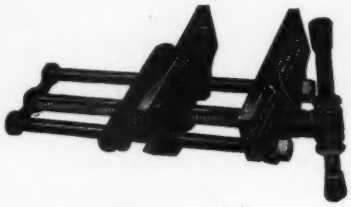
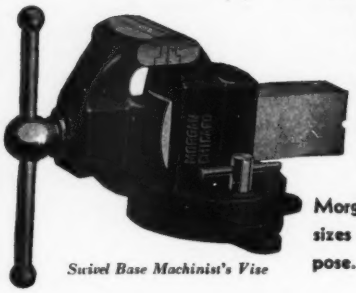




Perform a service to your school and give your students a real vise to work with. Specify MORGAN when you equip your shop, and get the best at no extra cost.



Swivel Base Machinist's Vise

Morgan vises represent more than 30 years of experience in manufacturing vises. The best materials and exacting workmanship mean strong, rigid and long lasting service in Morgan Vises.

Morgan vises can be had in various sizes and styles, to meet every purpose. Write for literature and prices.

MORGAN VISE CO.
120 N. Jefferson Street Chicago, Illinois

(Continued from page 20A)

Page

1. Title page
2. Chart of chemical reaction (see Fig. 1)
3. Antiknock fuels
4. Clippings from advertising materials of ethyl gasoline, etc.
5. Formulas and symbols
6. Diesel engine and description
7. Cuttings describing Diesel engines and illustrations

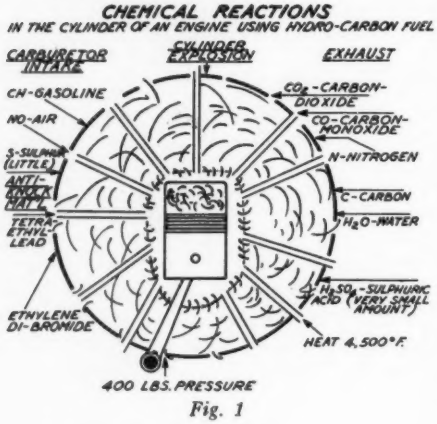


Fig. 1

8. Fire-extinguisher chart.
9. Diagram of blast furnace
10. Diagram of Bessemer converter
11. Cuttings describing various steels
12. Heat treatment of steel

Looseleaf notebooks are, of course, the best to use for this type of work. Pages can be inserted at will and placed in the section of the book where the material is related. Sketching appeals to these boys also. They like to draw diagrams and pictures. So, in the making of their notebooks, sketching and diagrams comprise at least 60 per cent of the space.

A brief explanation of the chart shown in Figure 1 follows. Chemical reaction was studied of the combustion of gasoline and air in the cylinder of an internal-combustion engine. The chart shows in diagrammatic form the materials as they enter the carburetor, their splitting up and recombination (chemical reaction) during the explosion or power stroke, accompanied by light and heat, and finally the products of combustion leaving the exhaust. This led to the study of the explosion in other types of internal-combustion engines, the Diesel, for example, and the gas engine. Another discussion centered on the possibility of utilizing other forms of hydrocarbon fuels as sources of power. In studying the nature of the explosion under various degrees of compression (compression ratios) the subject of antiknock materials was introduced. From references, charts were made illustrating the effect of antiknock compounds on the speed of the explosion in the cylinder.

Integrating their work in the science class with that in the drafting room, members of the class made a series of posters, many of which were enlargements of the sketches and diagrams described previously. These were made on large size drawing paper and added much interest to the work. Many benefits are to be derived from the making of posters of this type. First, they provide excellent teaching material which accumulates from semester to semester. Second, they furnish a still further outlet for the initiative and creativeness possessed by so many of the students. Photographs taken during regular class periods by members of the camera club who are also students in the industrial-science class, may also be used in making up these notebooks and posters.

Special Experiments

In developing a course of this type it becomes necessary for the instructor to plan and write many special experiments. Here is one worked out during the study of copper,

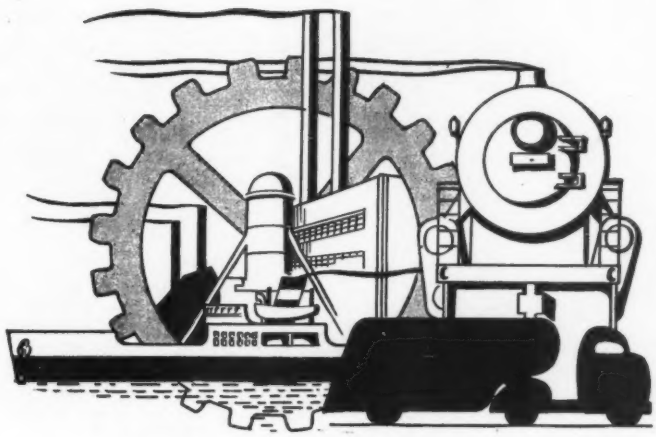
Experiment: To Determine the Acid-Resisting and Other Properties of Copper and Copper Compounds

A. Take a small piece of tarnished sheet copper and warm it gently in a test tube containing about 15 cc. of diluted HCl. Note any changes which may occur.

Notes. The copper was cleaned. The green copper carbonate and copper oxide were dissolved by the acid. The liquid turned greenish in color. The copper was not affected by the acid.

Practical uses in industry. Copper piping and sheeting coated with lime or car-

(Continued on page 24A)



"... BECAUSE THE INSTRUCTOR KNEW HIS STUFF"

Plenty of praise has been heaped upon American industry's shoulders — praise for the part it has played in making possible the present high standard of living.

Rightfully, however, a lion's share of this praise should be given the technical instructor in the American grade school, high school, trade school and college. Practically every worthwhile contribution made toward improving products and production methods has been made by men who received their first practical training from instructors who "knew their stuff."

Nearly every workable idea industry now uses has been conceived by men whose early instructors taught them how to think.

It might safely be said that industry is what it is today because the modern technical instructors have the knack — and the opportunity — to start boys and young men on the way toward lives of industrial usefulness.

The Lufkin Rule Company is also proud to have contributed a share toward American industrial progress. For fifty-eight years Lufkin Tapes, Rules and Precision Tools have been relied upon for their accuracy and durability in the classroom, shop, field and laboratory.

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For Economical Finishing— Industry uses GARNET

Whether it be for the belt sanding of a buffet, the drum sanding of a door panel or the hand sanding of a moulding, you're sure to find Behr-Manning Garnet Products in constant demand by operators in wood working shops throughout the country.

Economical? Write today for trial samples of these long-lasting coated abrasives for convincing proof that you can "reduce the cost per piece sanded"!

BEHR-MANNING

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TROY, N. Y. and 15 Branches

Educational Service Department

1A39

(Continued from page 22A)

bonate of copper may be cleaned by HCl without affecting the copper. Brass valves, injectors, and other apparatus used on steam boilers and hot-water piping made of copper may be cleaned by being placed in a lead bath containing diluted HCl.

B. Repeat A using HNO_3 and note any changes which may occur.

Notes. The copper dissolved. The acid turned to a deep blue-green color. A heavy brown gas escaped from the test tube. The copper was oxidized and then dissolved.

C. Take the solution in B and add water to make up to about 100 cc. Use a beaker or flask for this. Put a few iron filings into the beaker and add about 5 cc. of dilute H_2SO_4. Note the changes which occur.

Notes. The iron filings changed from gray to reddish-brown. The solution changes color slightly from blue-green to green. The iron replaces the copper in solution. A colorless gas (hydrogen) escapes.

Practical uses in industry. When steel pieces are prepared for the "layout bench" they are rubbed with a rag soaked in copper sulphate (blue vitriol). Due to the iron being replaced by the copper a thin layer of copper is left on the steel. This makes the "layout" work easier because the copper is then more clearly marked by means of a steel scriber.

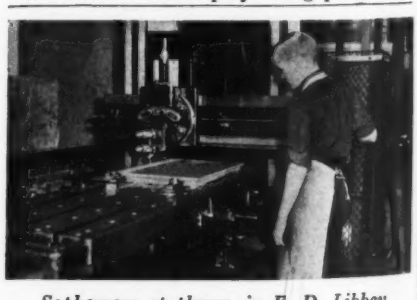
Other experiments included are as follows:

1. Identification of iron and steel by spark test.
2. Distillation of crude oil.
3. Softening of hard water by zeolites.
4. Tool marking by etching.
5. Making a fire extinguisher.

Conclusion

The related industrial-science courses described here, attempt to make such industrial-arts and vocational-education courses as practical as possible; to bring in only that material which a worker in industry will use and to teach it, whenever possible as it is used. Industrial education is defined as "the systematic and institutionalized effort of society to promote by educational methods the adaptation of its members to the changing conditions of livelihood activity." Related-science courses cannot remain static and justify their existence in a modern progressive curriculum. They must continually progress with the changing conditions in industry and life in general. For the instructor it means a considerable amount of work in the reading of technical magazines and trade periodicals. It also means close co-ordination between the classes and industries for which they are preparing. Frequent inspection trips make this possible and part-time apprenticeship. When convenient, the instructor should participate in the work of the trade or industry prepared for in his classes. This can be done by summer work and by arrangement with the industries concerned.

The importance of related science in industrial-education work is growing. There seems to be evolving an opinion that, because of the great expenditures in equipment involved and the almost impossible task of placing within any one school system the necessary instructors and material for more than a few trades, industry itself must co-operate and assume the responsibility of developing the necessary skill in trade techniques in the young workers. It is the duty of the school to discover, and develop to some extent, aptitudes and attitudes and give students in industrial education, comprehensive training in the arts and sciences related to trade techniques with the additional instruction in economics and citizenship. In such a program related science would play a big part.



Sophomore at planer, in E. D. Libbey High School, Toledo, Ohio

DIXON CHASING TOOLS

Made of best Tool Steel, Tempered to the exact degree of maximum toughness

FIG. S 2143 MATTING TOOLS
FIG. S 2144 PLAIN TOOLS

Illustrations show actual Size Tools

FIG. S 2145

FIG. S 2146 CUT A

FIG. S 2146 Cut B

FIG. S 2146 Cut C

● *Write for Circular CH containing Illustrations and Prices of Individual Tools*

AN ENDLESS AMOUNT OF INTERESTING CHASING AND REPOUSSE WORK CAN BE DONE WITH THE PLAIN TOOLS (Figures S 2144, and S 2145), WHILE THE BACKGROUND AND DECORATING TOOLS (Cuts, A, B, and C) PROVIDE A WIDE DIVERSITY OF PATTERNS TO MEET A BOUNDLESS RANGE OF REQUIREMENTS.

Price List

Fig. S 2143 Set of 4..... $ 2.40	Fig. S 2145 No. 10, Set of 22..... $8.00	Fig. S 2146 Cut B, Set of 13..... $4.25
Fig. S 2144 Set of 20..... $10.00	Fig. S 2146 Cut A, Set of 24..... $8.00	Fig. S 2146 Cut C, Set of 8..... $4.50

WILLIAM DIXON INC. 32 E. Kinney Street Newark, N. J.

Outline of Oxyacetylene-Welding Course

C. E. Barker

Director Industrial and Vocational Education,
San Francisco Public Schools,
San Francisco, California

Fusion welding is the uniting of metal while in the molten state in such fashion that the physical, mechanical, and chemical properties of the metals are not seriously modified at the weld. The joint and the weld should closely resemble the original structure on completion.

The course outlined herewith is designed for the needs of 15 students meeting five 1-hour periods per week for one semester (20 weeks).

History of Welding

1. Acetylene welding offers an interesting and useful field for the novice.
2. Early laboratory uses of gases and their application to industrial uses.
3. Invention of torch and the acceptance of gases as an industrial welding fuel.
4. Industrial adaptations of oxyacetylene as a welding fuel and its utility in modern industry.
5. Displacement of mechanical means of fastening in structural work.
6. Reductions of losses due to careless and unavoidable causes in manufacturing parts. Repairs.
7. Future outlook for oxyacetylene welding in industry.
8. Specific uses of electric and oxyacetylene welding and cutting.

Minimum Equipment and Supplies

1. Fifteen torches of different manufacturers of the medium-pressure type.
2. Extra tips for the above torches of various sizes.
3. Three cutting attachments for torches.
4. Manifold lines of pipe for both oxygen and acetylene (may be 5-tank *Star* type manifold or 5-tank *Wall* type manifold for each gas).

NOTE: A 60- to 70-per-cent saving in cost of acetylene can be effected by installing an acetylene-gas generator.

5. Gauges, regulators, and suitable hose connections at each outlet for torches.
6. One firebrick-covered worktable for each two students.
7. Anvil, hammers, grinding wheel, tongs, vises, and testing machine.
8. Torchlighters, goggles for each student; C clamps; extra firebricks to support work, flux boxes.
9. Welding rods of various sizes for steel, cast iron, bronze, and aluminum.
10. Fluxes for cast iron, brazing, and aluminum.

Gases

1. The burning of acetylene with oxygen and air is the usual method of producing a welding flame for oxyacetylene welding in industry.

NOTE: It requires 2½ volumes of oxygen to consume one volume of acetylene gas (1.02 volume of oxygen comes from the tank and 1.48 volume of oxygen is derived from the air).

2. It costs about one cent per minute for gases to operate a torch with a No. 3 tip.
3. In cutting with oxyacetylene it requires 1½ cu. ft. of oxygen gas to displace 1 cu. in. of iron.
4. Both oxygen and acetylene are usually stored in tanks under heavy pressure: Oxygen at about 2000-lb. pressure at 70 deg. F.; acetylene at about 240-lb. pressure at 70 deg. F.

NOTE: The tanks of acetylene are filled with a porous material and a fluid called *acetone* which has the peculiar property of being able to absorb 29 times its volume of acetylene gas. Only one seventh of the capacity of an acetylene tank can be withdrawn per hour without siphoning *acetone* along with the gas. There is also a loss of 10 per cent of

A subject which is getting more and more attention in the school shops of this country.

(Continued on page 26A)

SHELDON
Back Geared
Screw Cutting
PRECISION
LATHES
A complete line of full sized, full weight 10", 11" and 12" Precision Lathes . . . bench, floor and pedestal types built to industrial machine tool standards and specifications. Rigid heavily braced, semi-steel beds with hand scraped ways—2 "V"-ways and 2 Flat Ways. Large hardened steel spindles, ground all over and individually fitted into hand scraped bearings. Each lathe has a full compliment of attachments and accessories. Each model gives more lathe per dollar.
See the SHELDON before you buy.
For schools the Type U Sheldon Lathe (illustrated) is ideal. Full Bowl Headstock and Cabinet Leg enclose all gears, cones and belts. 4-speed roller bearing V-belt Drive has 2 Outside Shift Levers that permit students to change speeds without touching belt or pulleys. Full Quick Change Gear Box (4 to 224 threads per inch). Longitudinal Worm Feed with Power Cross Feed.
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(Continued from page 25A)

acetylene gas to each tank as this amount of gas remains in solution with the acetone at atmosphere pressure.

5. Approximate cost of gases: Oxygen: $1.85 per 100 cu. ft. or $4 per tank; acetylene: $3.60 per 100 cu. ft. or $9 per tank.

NOTE: Acetylene can be generated at a cost of $6 per 475 cu. ft. with an acetylene generator. However, this requires a special fireproof housing, water supply, and drain.

Teaching Points on Tanks

1. Construction of tanks
2. Capacity
3. Weighing
4. Safe pressure
5. Flow of gases per hour
6. Capacity drain per hour
7. Gauges and regulators
8. Pressure gauges
9. Manifolding
10. Economical use of gases
11. Where purchased
12. Deposit on tanks
13. Demurrage charge on tanks
14. Position
15. Handling
16. Storage

Connecting Tanks on Line

Cracking: Right- and left-hand threads on tanks, valves, and regulators to distinguish gases.

a) Acetylene — left-hand threads.

b) Oxygen — right-hand threads.

c) ¼-in. pipe thread is standard for tanks, regulators, and gauges.

Safety: Connecting gauges and regulators to tanks. Precautions which should be taken.

Acetylene valve is opened from 2½ to 3 turns.

Oxygen valve is opened all the way to avoid injuring packing.

Working pressure: Acetylene is never used over a *maximum pressure of 15 lb.*

Adjust pressure to suit size of tip and as a general rule the number of the tip should equal the pressure of the acetylene, i.e., for No. 3 tip use 3-pounds acetylene-gas pressure.

Oxygen pressure is regulated to suit size of tip being used for welding or cutting.

Pipes and hoses: Acetylene-gas lines and hoses are distinguished by red color.

Oxygen-gas lines and hoses are distinguished by green color (U. S. standard). (Black for oxygen is becoming obsolete.)

Types of Torches

Medium-pressure type, up to 15 lb. of acetylene.

Medium-low-pressure type, over 1 lb. of acetylene.

Low-pressure type, under 1 lb. of acetylene.

Reverse-pressure type, oxygen at higher pressure than acetylene.

NOTE: Torches are also designated as to where the gases are mixed: (*a*) tip mixers, (*b*) handle mixers.

Features Which Determine the Quality of a Torch

1. Construction and quality of materials.
2. Cast, built up, or forged.
3. Soldered, brazed, or screw assembled.
4. Balance and weight.
5. Accessibility for repairs.
6. Interchangeability of like equipment.
7. Service maintained by manufacturer.
8. Whether torch is in general use.
9. Special torches and cutting attachments.

Teaching Points on Torch

1. Medium-pressure type of torch generally used.
2. Selection of proper size tip for work.
3. Point of torch where gases are mixed.
4. How to adjust flame: (*a*) Flow of acetylene, (*b*) flow of oxygen.
5. Carbonizing, oxidizing, and neutral types of flames.
6. Use of three types flames.
7. Adjusting size of tip to suit work.
8. Position of flame on work.
9. Methods of holding torch.
10. Backward and forward welding.
11. Travel of torch in regard to welding rod.
12. Flashbacks and backfires — causes and prevention.
13. Correct flame to use: (*a*) Carbonizing flame, effect of, (*b*) oxidizing flame, effect of, (*c*) neutral flame and its use, (*d*) heating and cutting flame, (*e*) preheating.
14. Movement of flame over work.
15. Position of rod in regard to flame.
16. Dropping metal from rod into weld.
17. Melting rod in puddle.
18. Preparation of weld.
19. Width of weld.
20. Proper size of tip and flame to penetrate weld.

General Teaching Points

1. Safety instructions.
2. Connecting tanks.

(Continued on page 28A)

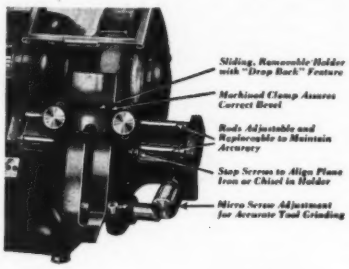
STANLEY ELECTRIC TOOLS

FOR SCHOOL SHOPS

EDUCATIONAL DEPARTMENT

STANLEY ELECTRIC TOOL DIVISION
THE STANLEY WORKS, NEW BRITAIN, CONN.

No. 667 EDGE TOOL GRINDER — An ideal slow-speed, ball bearing grinder for school use. Two 7″x1″ wheels—one for general purpose work, the other specially designed for edge tool grinding. Includes Safety Eye Shields, Adjustable Light Fixture, and the Plane Iron and Chisel Grinding Fixture below.


Sliding, Removable Holder with "Drop Back" Feature
Machined Clamp Assures Correct Bevel
Rods Adjustable and Replaceable to Maintain Accuracy
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Micro Screw Adjustment for Accurate Tool Grinding

PLANE IRON AND CHISEL GRINDING FIXTURE — To keep edge tools in perfect condition with ease and accuracy. Furnished with No. 667 Grinder above.

STANLEY "VICTOR" DRILL No. 124

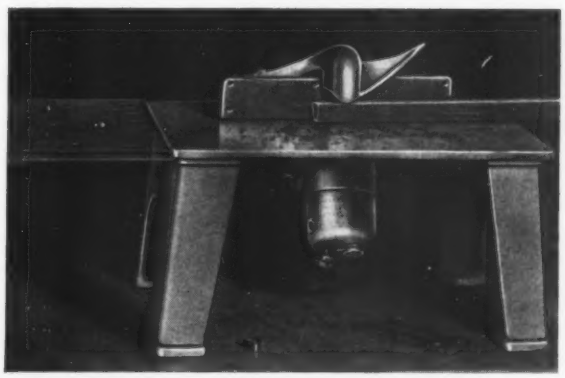
A practical electric drill for the school shop. Its three-jawed geared chuck accommodates standard round-shank twist drills and bits, hole saws, countersinks, plug cutters, etc., up to ½″ shanks. The addition of the Drill Stand shown here makes a fine combination at low cost.

DRILL STAND — For the No. 124 Drill listed above. There is a Stanley Drill Stand for every Stanley Electric Drill.

HAND ROUTER No. 10 Its 18,000 R.P.M. produces a smoothness of work that makes sanding generally unnecessary. In addition to shaping, inlay work, routing, templet work, veining, grooving, rabbeting, corner beading, etc., the power unit of this useful router is quickly attached to the Beading and Fluting unit or the Shaper Table, shown below. Such adaptability combines economy and wide scope in school shop use.

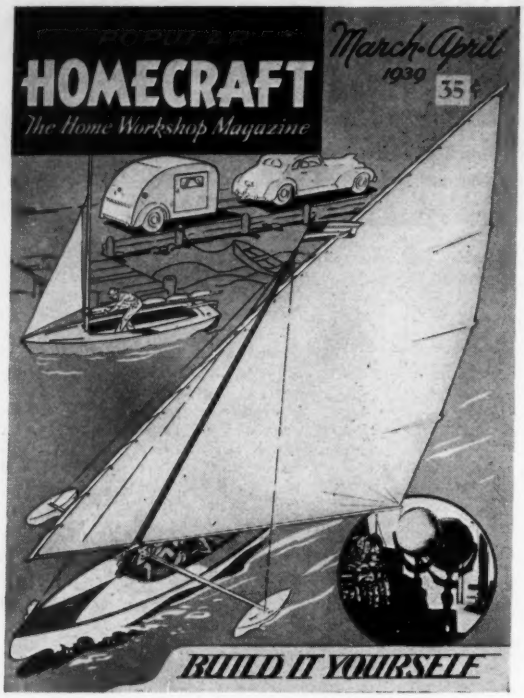
BEADING AND FLUTING ATTACHMENT No. 64

Employs the power unit of the Hand Router above. Easily used with a lathe or your own holding device where a lathe is not available. Includes a guide collar adjustable to depth of cut, to insure following the contour of the work.



SHAPER TABLE No. 41—With this shaper table and the power unit of the Hand Router, you can produce an infinite variety of cuts without purchasing a special cutter for each. A patented tilting motor holder is adjustable from a vertical position to any angle up to 45°. With four cutters, many different moulding cuts can be made simply by rearranging the cutters on the Spindle, and by changing the angle of the motor unit.

You'll want to study a complete catalog of Stanley Electric Tools, or the interesting catalog describing Stanley Electric Router-Shaper Tools. A copy will be sent you gladly on request.



216 New Projects

in wood, leather, and metal work will be described during 1939 in the issues of POPULAR HOMECRAFT.

Industrial art teachers find this magazine particularly helpful because each project is new and is described in detail. All the necessary dimensions, detailed drawings, and illustrations are included.

Here, for instance, are a few features in the March — April issue:

(1) Two Lantern Globe Projects
(2) Modern Magazine Rack
(3) Weaving a Rush Chair Bottom (13 Illustrations)
(4) Butler's Coffee Table
(5) Sailing Kayak
(6) Small Trailer
(7) Globe Stand
(8) Turned Candlebra
(9) Six Departments

You will find something in each issue that will arouse the interest of students of different ages. You will find POPULAR HOMECRAFT to be a real assistant to you in your work.

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A sample of a recent issue will be sent in case you are not acquainted with POPULAR HOMECRAFT.

A special 50-page Portfolio will be sent to those entering new subscriptions at this time.

Write to

POPULAR HOMECRAFT . . . . 919 No. Michigan Ave., Chicago, Ill.

(Continued from page 26A)

3. Adjusting regulators.
4. Reading gauges.
5. Pressure on acetylene gauge (15 lb. maximum). (Number of pounds usually is equal to the number of the tip being used.)
6. Pressure on oxygen gauge (to suit size of tip).
7. Amount of acetylene per hour (1/7 capacity of tank).
8. Selection of tip for job.
9. Adjusting of flame.
10. Kinds of flame.
11. Length of inner cone.
12. Holding torch.
13. Arranging weld.
14. Allowance for contraction and expansion.
15. Width of weld.
16. Penetration.
17. Size of rod to use.
18. Kind of flux to use.
19. Safety factors.
20. Use of goggles to protect eyes.
21. Position of tanks.
22. Handling of cylinders.
23. Testing of filler rods.

Flames

Flame should be 2½ times as long as diameter.

Types of flame

1. Neutral.
2. Carbonizing.
3. Oxidizing.
4. Cutting.
5. Invisible welding flame.
6. Three sections of cone (inner cone, etc.).

When the gases ignite in the tip, it is called a *backfire*, and when they burn in the hose, or when the speed of the burning exceeds the speed of flow of the gases, it is called a *flashback*.

The *direction* of movement of welding rod and flame determines whether it is *backward* or *forward* welding.

Welding Exercises

1. Beading.
2. Weld thick plates.
3. Thin and thick pieces.
4. Weld thin sheets.
5. Built up weld.
6. Horizontal.
7. Flat and overhead.
8. Vertical.
9. 45 deg. overhead.
10. Cast-iron welding.
11. Built up C. I.
12. Rod welding.
13. Brazing.
14. Cutting.
15. Piercing.
16. Weld steel to iron.
17. Semisteel.
18. Cast aluminum weld.
19. Preheating of cast iron.
20. Weld with left and right hand.
21. Observation of welds.
22. Test of welds.
23. Breaking and inspect weld.

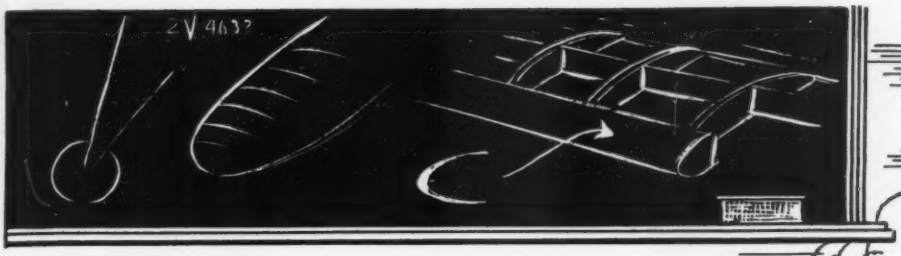
Observations of Weld to Indicate Its Quality

1. Regularity of surface.
2. Width at the top.
3. Grooving at sides or center.
4. Amount and shape of reinforcement.
5. Porosity of surface.
6. Sponginess of surface.
7. Number and location of oxide spots.
8. Width and color of heat effect.
9. Uniformity of heat effect.
10. Amount and character of scale due to heat.

Factors Affecting the Success of a Weld

1. Type of torch.
2. Gauges and regulators.
3. Sizes of filler rods and kinds.
4. Hoses.
5. Generator, size and tanks.
6. System, line or manifold.
7. Rate of withdrawal of gases.
8. Adjusting torch flame.
9. Size of tips.
10. Thickness of metal.
11. Angle of torch.
12. Purity of gases.
13. Temperature of gases.
14. Temperature of material.
15. Altitude.
16. Atmospheric conditions.
17. Thermal conductivity of material.
18. Thermal capacity of material.
19. Position of weld.
20. Location of work.
21. Condition of work (paint, mat, burned).
22. Expansion and contraction.
23. Preparation of joints.
24. Service requirements.
25. Flux used.
26. Annealing.
27. Preheating.
28. Amount of gases in cylinders.
29. Condition of tips.
30. Flashbacks and backfire.
31. Hoses, coiled or straight.
32. Speed of operator.

(Continued on page 30A)



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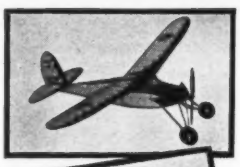
Without interest, school work is drudgery. With it, even the most difficult pupil reveals surprising abilities. Knowing this, many Industrial Arts teachers are actively

Model kits like the gas-powered PIPER CUB shown here offer excellent training in both construction and aviation principles. Features Megow's ready-carved Leading Edge, scale spacing of struts and ribs in wings and fuselage. Practically crackup-proof design. Wingspan, 52¾". $3.95 less motor. Postage 20c extra.

MEGOW MODEL KITS



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Megow HO-Gauge Model Railroad Equipment is widely known to the devotees of this fascinating hobby for its completeness, realism, accuracy and low price.

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Teachers of Industrial Arts desiring to cultivate greater public esteem for their departments may take active parts in local model airplane clubs and flying contests, and encourage students to enter classroom models.

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WIN THIS $100.00!

We intend to develop a series of charts covering the building and flying of Model Airplanes. It is our purpose to so design these charts that they will best assist the teacher and student in proper methods, and in addition include a correlation with actual airplanes.

$100.00 is offered for the best series of charts submitted to us. We believe that your experience in teaching will in principle assist us in developing charts that will be fully up to the standards acceptable to your profession. $5.00 each will be given for ideas submitted that we may also wish to use. Send in your suggestions, or write for further information.

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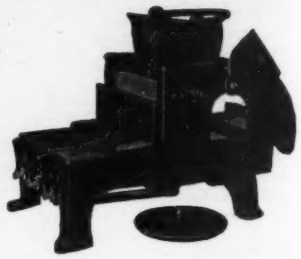

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JOHNSON GAS APPLIANCE Co. Cedar Rapids ICWA

(Continued from page 28A)

33. Working conditions.
34. Skill in manipulation of torch.
35. Pressure of gases.
36. Comparative melting points.
37. Rate of fusion.
38. Stress and strain weld is to be subjected to.

Burning or Oxyacetylene Cutting

1. Kinds and sizes of cutting torches and attachments.
2. Arrangement of work.
3. Starting of cut with neutral flame.
4. Increasing flow of oxygen.
5. Piercing.
6. Oxygen lance, heating metal to a white heat and then piercing with oxygen flow.
7. Cutting round and thick sections.
8. Cutting to a template.
9. Amount of oxygen consumed.

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Fundamentals of Welding, J. W. Owens.

The Welding Engineer, Magazine, 608 South Dearborn Street, Chicago, Ill.

Technical Paper No. 200, Bureau of Standards, Washington, D. C.

Local manufacturers and distributing agents have very valuable information for free distribution to students.

Technical Terms

1. Oxygen (chemical symbol)
2. Acetylene (chemical symbol)
3. Acetone (chemical symbol), 4. Sulphur
5. Phosphorous, 6. Silicon, 7. Chrome
8. Nickle, 9. Vanadium, 10. Manganese
11. Carbon, combined, graphite, 12. Tungsten
13. Bessemer process, 14. Open-hearth process
15. Cold-rolled steel, 16. Atmosphere
17. Neutral, 18. Flashback, 19. Backfire
20. Surface tension, 21. Fatigue, 22. Fusion
23. Adhesion, 24. Porosity, 25. Penetration
26. Diffusions of gases, 27. Carbonization
28. Oxidation, 29. Manifold, 30. Metallurgy

Related Technical Information

1. Symbols used on blueprints to designate welds
2. Kinds of gases
3. Weight of gases per cubic foot
4. Expansion of gases
5. Measurement of pressure
6. Properties of gases
7. Flow per minute
8. Storage of gases
9. Absorption of gases
10. Specific gravity
11. Speed of burning of gases
12. Knowledge of metals
13. Percentage of impurities
14. Effect of phosphorous
15. Effect of sulphur
16. 2½ volumes of oxygen is required to consume 1 volume of acetylene (1.02 volumes from tank, 1.48 volumes from atmosphere).

House-Planning Course for Girls

Einar J. Anderson

Maine Township High School, Park Ridge, Illinois

Expanding industrial-arts offerings so that its benefits can also be obtained by the girls.

One hundred girls are now enrolled in the house-planning course which has been introduced at Maine Township High School, Park Ridge, Ill. If anyone should drop in and visit these classes, he would find the girls drawing plans of their ideal kitchens, dining rooms, living rooms, bedrooms, and bathrooms. Others may be occupied with the fascinating study of prevailing architectural styles of houses, while still others will be drawing perspective sketches of "houses of their choice."

In this new course which is the only known course of its kind offered in an Illinois high school, the girls are taught to make, read, and understand ordinary blueprints, to draw houses to scale, and to make landscape layouts. A study is also made of interior decoration and furniture styles. The aim of the course is also to

(Continued on page 33A)

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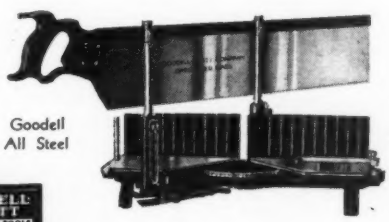

Goodell All Steel

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3
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MADE OF A

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EXTREME HARDNESS for Infinite Wear.
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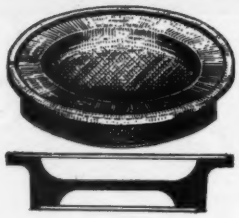
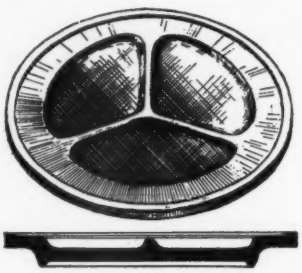


No. 1190

No. 1191



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EXTRA HARD
ALLOY CASTING

No. 1190A 3¾″ and 4½″ Round $1.35 Each

No. 1190B 5¼″ and 7″ Round $3.15 Each

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No. 1192 Duplex Form, Bridgeset $3.00 Each

No. 1193 Hors D'Oeuvre Dish 10″ $4.75 Each

No. 1194 Oval Bread Tray 10½″x8″ $7.00 Each

No. 1195 Rectangular Serving Tray 15″ x 9″ $6.50 Each

Ask for 6-page Folder "Wrought Iron and Beaten Metal" showing these Forms, Jobsheets, Tools etc.

(Continued from page 30A)

develop an appreciation for good architecture. The course is on the academic level both as to time and credit. Clarence J. Rogers is the instructor.

Aim Not Vocational

This course has not been introduced to give vocational training. The modern non-technical high school is more concerned in offering boys and girls a wide range of subjects from which they may discover their interests and aptitudes. With a reported shortage of some 480,000 house units in the United States today, and so much discussion about building and owning one's own home, there is certain to be a continued if not greater interest in houses for some time to come. The house-planning course has been arranged to be as practical as possible.

Such statements as "I didn't know there was so much to learn about planning a house," "I think I would like to be an interior decorator," and "Will I be able to take more than one year of house planning?" made by some of the girls when interviewed, indicate the response that the course is receiving. The present classroom facilities of the school are the only thing which keeps the enrollment from going much over the century mark.

Class in house planning

Equipment and Supplies

The house-planning classes meet in the architectural-drawing room which is equipped with twenty-five drawing desks, each of which has a locker for each period of the day. Each desk is equipped with a T square, triangles, and scale, which are the instruments used in the house-planning course. Special equipment and books are available in a general case accessible to all. The adjoining room is equipped with a blueprinting machine where each girl makes blueprints of some of her own drawings.

An interesting unit which is being carried out at the present time is the rearrangement of a room. Each girl receives a blueprint of a room with doors, windows, and furniture all out of place and it is her problem to redraw the room well balanced. This unit will be followed with a floor plan and the adjoining walls to be drawn and the walls folded up so that she may look inside and see how they would appear in a house.

Why and *how* are such useful questions that they cannot be uttered too often.

(Turn to page 38A)

GRADUATES *will find* CRESCENT *machines everywhere . . .*

A Crescent trained man is of immediate value when he starts on the job — for nearly FIFTY YEARS Crescent machines have more than held their own in the tough grind of production — that is why graduates find Crescent machines everywhere.

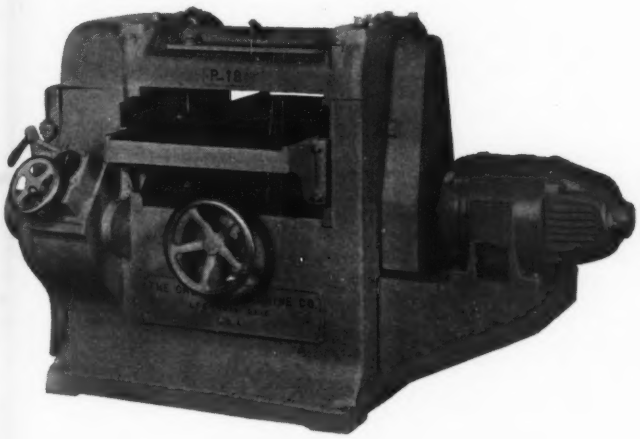
P-24 24" x 8"

The fastest selling planer on the market—cabinet finish up to 60 feet per minute guaranteed.

Compare these Features

- Reeves Variable Speed Drive
- Finger-tip Control
- Built-in Direct Motor Drive
- Knife Grinding and Jointing Attachment
- Totally Enclosed with Aluminum Guards
- Grease-gun Lubrication
- Precision-type Ball Bearings

Write for literature



P-18 18" x 6"

The P-18 (above) is a fit companion to the already famous P-24—a fast sturdy intermediate planer, efficient in school or factory. Write for literature.

The P-14 is not so large but no less efficient. Designed to produce—built of the best materials. It is the answer to many shop problems. Write for literature.

P-14
14" x 6"

SAFE • ECONOMICAL • RELIABLE

The Crescent Machine Company

100 Cherry Fork Avenue **Leetonia, Ohio, U. S. A.**

Metalworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Air Compressors — for machine shop, foundry, or forge shop
Anvil — 100-lb.
Arbor Press — bench or pedestal type
Barrows
- *a*) Coke
- *b*) Foundry
- *c*) Scrap

Belt Lacer
Benches
- *a*) Coremaking
- *b*) For metal working, iron or steel legs. Tops, metal or hardwood lumber, 1¾ in. to 2½ in. thick
- *c*) Molding

Blackboard — permanent or portable
Blowers — for furnaces, forges, etc.
Blowtorch — 1 qt. size
Bookcase — for reference books, catalogs, etc.
Boring Bar
Boring Mill — vertical or horizontal
Bulletin Board
Cabinets — Wood or metal, for filing class records, instruction sheets, drawings, etc., and for tools and supplies
Casehardening Boxes
Centering Machine
Chain Hoists — differential, duplex or triplex
Chairs — teacher's and tablet-arm, if needed for related-subjects room, or for demonstration section
Chuck
- *a*) Drill, selected sizes
- *b*) Lathe, combination, 4-jaw, selected sizes
- *c*) Lathe, independent, 4-jaw, selected sizes
- *d*) Lathe, universal 3-jaw, selected sizes
- *e*) Milling machine, universal

Core Oven — for foundry
Cranes and Hoists — air, electric or hand, of the jib, traveling, or portable type
Cupola — for foundry, coke, or electric, ¼ to 1-ton capacity
Desk — teacher's, with drawer compartments
Die-Filing Machine
Dividing Head
Drills
- *a*) Bench, hand
- *b*) Breast
- *c*) Electric, portable
- *d*) Hand
- *e*) Post, hand or power
- *f*) Radial
- *g*) Sensitive
- *h*) Upright, power

Flasks — 2 or 3 part, steel or snap type
Forge — coal or gas, with hand or electric-driven blower
Furnaces
- *a*) Annealing
- *b*) Bench
- *c*) Brass and soft metal
- *d*) Combination bench
- *e*) Casehardening
- *f*) Cyanide
- *g*) Gasoline
- *h*) Heat treating
- *j*) Melting

Gear-Cutting Machine
Grinder
- *a*) Bench, hand or power driven
- *b*) Combination grinder, buffer and polisher
- *c*) Emery, bench or pedestal type
- *d*) Face, with magnetic chuck
- *e*) Portable tool post
- *f*) Precision, for external and internal grinding
- *g*) Universal tool cutter, drill and reamer grinder
- *h*) Wet tool

Hack Saw — motor or belt driven
Hand Picks — for cleaning inside of cupola, 1¼ to 2½ lb.
Hardness Testing Machine
Lathes — belt or individual drives
- *a*) Automatic
- *b*) Bench, 6 in. to 11 in. swing, 11 in. to 36 in. between centers
- *c*) Change gear, 9 in. to 14 in. swing, 18 in. to 36 in. between centers
- *d*) Quick-change gear, 9 in. to 16 in. swing, 18 in. to 36 in. between centers
- *e*) Semiquick-change gear, 9 in. to 18 in. swing, 18 in. to 42 in. between centers
- *f*) Turret
- *g*) Metal spinning

Milling Machine
- *a*) Plain, cone or motor-driven type
- *b*) Universal, cone or motor-driven type

Nibbling Machine
Pipe Cutter
Planer — belt or motor driven
Power Hammer — for forging operations
Punches — metal, hand, or power
Pyrometer
Pyroscope
Relieving Attachment for Lathe
Sand Sifter — for foundry, hand or power
Sandblast Outfit — with cabinet
Scale
- *a*) Counter for machine shop
- *b*) Platform, for foundry, 1000-lb. capacity

Shaper
Snap-Flask Jackets — to fit snap flasks used
Straightening Press
Surface Plates
Swage Block and Stand — for forge shop
Taper Attachment for Lathe
Truck — warehouse
Tumbling Barrel — for foundry
Vises
- *a*) Blacksmith
- *b*) Drill press
- *c*) Machinist
- *d*) Pipe
- *e*) Planer
- *f*) Shaper

Welding Outfit
- *a*) Acetylene
- *b*) Electric

Metalworking—Small Tools

Arbors
- *a*) Drill chuck to suit requirements
- *b*) Reamers, various sizes
- *c*) Shell tool, various sizes
- *d*) Straight shank for shell reamers and shell drills, selected sizes
- *e*) Taper shank for shell reamers and shell drills, selected sizes

Bearing Scraper
Bellows — for foundry class
Bevel Protractor
Brooms and Floor Brushes — for shop and foundry
Brushes
- *a*) Bench
- *b*) Core box
- *c*) Core painting
- *d*) Hard brushes for foundry
- *e*) Floor
- *f*) Soft brushes for foundry

Bulb Sponges — for molders
Draw Pins — for molders
Calipers
- *a*) Hermaphrodite, 4 in. and 6 in.
- *b*) Inside, 4 in. and 6 in.
- *c*) Outside, 4 in. and 6 in.

Cans
- *a*) Oil, 1/3-pt., 1-pt., and 10-gal.
- *b*) Waste

Center Testers
Chisels
- *a*) Cape, 3/8 in. and 5/8 in.
- *b*) Cold, 5/8 in. and ¾ in.
- *c*) Diamond point, 3/8 in. and ½ in.
- *d*) Round nose, 3/8 in. and ½ in.

Clamps
- *a*) 4 in., 6 in., 8 in., and 10 in.
- *b*) Flask, for foundry
- *c*) Strap, various sizes

Coke Forks — for foundry
Collets
- *a*) For milling machine, selected sizes
- *b*) For lathe, selected sizes

Combination Squares — with hardened head and blade, and protractor head, 9 in. and 12 in.
Counterbores — straight and tapered shanks, selected sizes
Countersinks — for metal
Crucible Tongs — to fit crucibles
Crucibles — selected sizes
- *a*) Shanks, single-end to fit ladles
- *b*) Shanks, hand, to fit ladle bowls

Cutters — angular-milling, bevel-gear, concave-milling, convex-milling, end-milling, face-milling, formed-milling, grooving, involute gear teeth, key-seat, side-milling, and metal-slitting
Dividers — Spring, 4 in. and 6 in.

(Continued on page 36A)

Model 1-H. Universal Type
Finger-touch safety controls . . . the famous K & T Double Over-arms . . . directional feed levers . . . plus other perfected features.

Model 2-HL. Plain Type
Compact, complete — with all tried and tested features usually found only in larger machines . . . low in height . . . minimum floor space . . . full back column . . . centralized controls.

MILWAUKEE Milling Machines, embodying all the features used in modern milling machine practice, have gained the acceptance of engineering colleges, technical high schools, and vocational schools throughout the country. Centralized controls, with built-in safety features, make it impossible to throw in power controls when hand controls are engaged — machines are adapted to the most inexperienced operators.

KEARNEY & TRECKER CORPORATION
West Allis Station **Milwaukee, Wisconsin**

MORE THAN 40 years OF DOING ONE THING WELL

K&T Milwaukee MILLING MACHINES

(Continued from page 34A)

Drill
- *a*) Drifts, different sizes
- *b*) Drill sleeves, different sizes
- *c*) Stand for Nos. 1 to 60
- *d*) Stand for 1/16 in. to ½ in. by 64ths

Drills
- *a*) Center
- *b*) High-speed, taper shank, various sizes
- *c*) Jobbers, straight shank, 1/16 in. to ½ in. by 64ths
- *d*) Ratchet
- *e*) Straight shank, Nos. 1 to 60
- *f*) Taper shank, ½ in. to 1 in. by 16ths

File Cards

Files
- *a*) Die sinkers, various shapes
- *b*) Flat bastard, 8 in. and 10 in.
- *c*) Half-round, double cut, 6 in., 8 in., and 10 in.
- *d*) Hand, smooth, 8 in. and 10 in.
- *e*) Mill, smooth, 8 in. and 10 in.
- *f*) Round bastard, 8 in.
- *g*) Square bastard, 8 in.
- *h*) Swiss, various shapes
- *j*) Three-square, double cut, 6 in.
- *k*) Warding, double cut, 6 in.

First-Aid Cabinet and Supplies

Forge Tools — drift pins, flatters, fullers, hand and handle punches, hardies, hot and cold cutters, set hammers, and swages for the forge shop

Gate Sticks — maple, for foundry

Gauges
- *a*) Center
- *b*) Depth
- *c*) Drill and wire
- *d*) Screw pitch, select kinds
- *e*) Surface

Gloves — asbestos, for foundry

Goggles
- *a*) For machine shop
- *b*) For foundry

Hack Saw
- *a*) Blades, hand, 18T, 10 in.
- *b*) Blades, power, 14T, 12 in.
- *c*) Frames, adjustable

Hammers
- *a*) Babbitt
- *b*) Ball-peen, 13-, 16-, or 20-oz.
- *c*) Blacksmith's, various kinds
- *d*) Riveting, 9- and 12-oz.
- *e*) Setting

Indicator
- *a*) Center
- *b*) Universal or universal dial test
- *c*) Speed

Knurling Tool — with assorted knurls

Ladles
- *a*) Bull
- *b*) Hand bowls
- *c*) Melting

Lathe Dogs — ½ in., ¾ in., 1 in., 1½ in., 2 in., 2½ in., and 3 in.

Leggings — fireproofed duck, to protect students when pouring in foundry

Level — 6 in. bench

Lifting Screws — for molders

Mallets — wood or soft

Mandrels — selected sizes

Micrometers — inside, 1½ in. to 8 in.; outside, 0 to 1 in.; outside, 1 in. to 2 in.; outside, 2 in. to 3 in.

Molding Boards

Molding Sticks and Trowels — various kinds

Nippers — end-cutting, 5 in.

Oil Storage Tank — with pump

Oilstones — medium and fine

Pails — galvanized, 12-qt. capacity for foundry

Parallels
- *a*) Adjustable
- *b*) Steel, assorted sizes

Pliers
- *a*) Combination, 6 in.
- *b*) Side-cutting, 6 in.

Punches
- *a*) Center, ¼ in. and ⅜ in.
- *b*) Hollow, ½ in., ¾ in., and 1 in.
- *c*) Pin, ⅛ in., 5/32 in., 3/16 in., 7/32 in., and ¼ in.
- *d*) Prick, ¼ in.

Rammers — for foundry
- *a*) Hand
- *b*) Floor

Reamers — various sizes
- *a*) Adjustable
- *b*) Hand
- *c*) Taper pin
- *d*) With taper shank

Riddles — ¼ in. and ⅛ in. mesh, 18 in. diameter, for foundry

Rivet Sets — assorted sizes

Scales
- *a*) Steel, 6 in., graduated 1/64 in. to ⅛ in.
- *b*) Steel, 12 in., graduated to 32nds

Screw Drivers — 6 in. and 9 in. blade

Scribers

Shovels
- *a*) Coke
- *b*) Sand

Snips — tin, 3 in. straight and 3 in. curved

Sockets — for taper shanks, drill and tools, selected sizes

Soldering Coppers and Handles — 1-lb. size

Spray Can — for molders

Sprinkling Cans — galvanized iron, 16-qt. capacity, for foundry

Sprue Picks — for molders

Squares
- *a*) Machinists', 6 in.
- *b*) Blacksmith's

Steel Figures, ⅛ in.

Steel Letters — ⅛ in.

Swabs — for molders

Tapeline — steel, 25 ft.

Taps and Dies
- *a*) Machine screws
- *b*) Pipe
- *c*) S.A.E. ¼ in. to ¾ in.
- *d*) U.S.S. ¼ in. to ¾ in.

Tongs
- *a*) Blacksmith's, various kinds
- *b*) Pick-up, for foundry
- *c*) Shake-out, for foundry

Tool Holders
- *a*) Boring tools
- *b*) Cutting-off tools
- *c*) Planer
- *d*) R.H. and L.H. offset shank
- *e*) Shaper
- *f*) Slotter
- *g*) Straight shank
- *h*) Threading

Tool-Holder Bits — square, ¼ in., 5/16 in., ⅜ in., 7/16 in., ½ in.

Trammel Points

V Blocks and Clamps

Wheel Dresser

Wrenches
- *a*) Adjustable, 8 in. and 10 in.
- *b*) Pipe, 8 in. and 12 in.
- *c*) Tap, adjustable, various sizes

Metalworking—Materials and Supplies

Abrasive cloth — aluminum oxide. Grits 320 to 24, obtainable in sheets or rolls from 1 to 28 in. wide

Abrasive Wheels

Acetylene Gas — in drums for welding

Aluminum
- *a*) Pigs for foundry
- *b*) Sheets, tubing, rounds, shapes, wire, etc.

Babbitt Metal

Bearing Blue

Belt Dressing

Belt Lacing Material

Belt Leather

Bolts
- *a*) Carriage, selected sizes
- *b*) Lag, selected sizes
- *c*) Machine, selected sizes
- *d*) S.A.E., selected sizes
- *e*) Stove, flat or round heads, selected sizes

Brass
- *a*) Bars, 3/32 in., ⅛ in., 4/16 in., and ¼ in. thick; ⅜ in. to 1 in. wide, 8 ft. to 10 ft. long, selected sizes
- *b*) Round rods, 3/16 in. to ½ in. by 16ths, selected sizes
- *c*) Sheets, 28 to 32 American gauge, 12 in. wide x 72 in. to 84 in. long, selected sizes
- *d*) Strips, 1/32 in. and 1/16 in. thick, ½ in. to 1½ in. wide, 50 ft. to a coil, selected sizes
- *e*) Threaded rods, Nos. 6 to 10, in 24 in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24 in. lengths, selected sizes
- *f*) Wire, soft, 8, 11, and 14 American gauge, selected sizes
- *g*) Wire, spring, 8 to 22 American gauge, selected sizes

Casehardening Compounds

Chaplets — single and double head

Coal
- *a*) Charcoal for foundry or forge
- *b*) Coke for foundry
- *c*) Forge

Copper
- *a*) Pigs, for casting alloys
- *b*) Sheets, 8 to 25 American gauge, 30 in. x 60 in., selected sizes
- *c*) Tubing, outside diameters, 3/16 in., ¼ in., 5/16 in., ⅜ in., ½ in.; thickness of wall, 1/32 in.; lengths, 8 ft. to 12 ft., selected sizes
- *d*) Wire, soft, 2 to 20 American gauge, in coils. Also in ¼-, ½-, and 1 lb. spools, sizes 16 to 36, English gauge, selected sizes

Core
- *a*) Compounds
- *b*) Flour
- *c*) Paste
- *d*) Oil
- *e*) Wax-vent wire

Cutting Compounds

Fire Bricks and Clay — for foundry

Fire Handles — assorted sizes

(Continued on page 38A)

TEACH The VALUE of QUALITY

Molding shop students into true *craftsmen*—respecters of fine work, fine materials, fine *tools*—is the most important job any shop instructor can have. . . . You'll start your charges in the right direction by specifying Morse Cutting Tools. For wherever *quality* is honored, the name of Morse is known and honored . . . "There IS a Difference!"

MORSE TOOLS FOR THE SCHOOL SHOP

(*above*)

No. 302 Taper Shank Drill. Of selected carbon steel, for all power drilling not requiring high speed.

No. 330 Straight Shank Drill. So-called "Jobbers'" drill of carbon steel, for use in all types of hand drilling.

(*above*)

No. 602 Hand Reamer. Spiral Fluted, carbon steel reamer, ideal for general hand use in the shop.

No. 717 Expansion Reamer. Available in ¼" to 2" diameters. Its expansion feature makes it highly useful in school shop work.

No. 1045 Spiral Pointed Hand Tap. For machine tapping of most common materials in through holes. Furnished in plug style only.

No. 1184 Adjustable Round Die. In all sizes and threads, for hand thread cutting of commonly used metals.

The Morse Catalog is a Guide to Fine Tools —write for your copy.

MORSE TOOLS FOR THE ADVANCED OR AUTOMOTIVE SHOP

No. 1302 High Speed Taper Shank Drills. Tempered and designed for steady production work in power-drilling machines. All sizes, from ⅛" to 3" diameters.

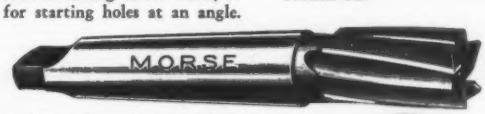
(*above*)

No. 1683 High Speed Taper Pin Reamer. Helical Flutes. Taper ¼" per foot. Indispensable in any work where taper pins are used.

No. 1728 High Speed Adjustable Reamer. Six tapered blades slide lengthwise in the body slots, and are firmly held in position for the desired diameter.

No. 495 Combined Drills and Countersinks. Made of Carbon Steel, in all popular sizes and types, for drilling and countersinking center holes, or for starting holes at an angle.

No. 773 Screw Extractor. A very useful tool for removing pieces of studs, bolts or screws from holes in which they have broken off.



No. 1805 Heavy Duty End Mill. Coarse-toothed, spiral heavy-duty mill. Available in either right-hand or left-hand types.

No. 1809 Alternate Tooth Milling Cutter. Alternate teeth provide a shearing cut and ample chip clearance for deep slotting in tough metals.

No. 1040 Hand Tap. All popular sizes and pitches. Plug style illustrated.

No. 1145 Tap Wrench. Furnished in sizes 0 and 1, to handle all taps from 1/16" to 5/16", and reamers from 1/8" to 15/32".

For convenient, orderly, systematic arrangement of drills, Morse Drill Blocks and Drill Cases are ideal for the school shop.

MORSE THERE IS A DIFFERENCE TWIST DRILL & MACHINE COMPANY NEW BEDFORD - - - MASS., U. S. A.

THE MORSE LINE INCLUDES HIGH SPEED AND CARBON DRILLS - REAMERS - CUTTERS - TAPS and DIES - SCREW PLATES - ARBORS - CHUCKS - COUNTERBORES - MANDRELS - TAPER PINS - SOCKETS - SLEEVES

(Continued from page 36A)

Graphite — for foundry
Iron — Pig, for foundry
Lacquer — transparent and colored, for finishing
Nuts — S.A.A., acorn cap, castellated, square, hexagon, joint, and wing, selected sizes and kinds
Oil
a) Boiled linseed
b) Lubricating
c) Quenching and hardening
Packing
Round, sheet, square, or tubular
Paint — black asphaltum
Pins
a) Cotter, 3/32 in. to ¼ in. diam. from ½ in. to 2 in. long
b) Flask, for flask repairs
c) Taper, Nos. 0 to 6, ¾ in. to 2 in. long
Pumice Powder
Rivets
a) Copper, with burrs, Nos. 7 to 14, lengths, ⅜ in. to ¾ in., selected sizes
b) Iron, No. 14 gauge to 3/16 in., flat-head or button-head, ¼ in. to 1 in. long, selected sizes
c) Tinners', flat-head, 8-oz. to 16-lb., either tinned or black, selected sizes
Sand
a) Molding, in 350-lb. barrels or 800-lb. casks
b) Parting, in 350-lb. barrels or 800-lb. casks
Screws
a) Flat-head or round-head iron or brass, selected sizes and kinds
b) Cap and machine, iron or brass, selected sizes and kinds
c) Set, head and headless
Solder — acid or rosin core; bar, or solid wire
Soldering Paste or Salts
Steel
a) Bessemer, rod, 1/64 in. to ⅜ in. by 64ths, in 4 ft. lengths, selected sizes
b) Bars, cold-rolled, ⅛ in. to ⅜ in. thick, ½ in. to 2 in. wide, 12 ft. lengths, selected sizes
c) Drill rod, letter sizes, A to Z, number sizes, 1 to 80, in 3 ft. lengths, selected sizes
d) Rods, hexagon and square, cold-rolled, ¼ in. to ¾ in., in 12 ft. lengths, selected sizes
e) Round, cold-rolled, diameters ⅛ in. to 1 in., lengths 12 ft., selected sizes
f) Sheet, black, Nos. 18, 20, 22, 24, 26, 28 U.S. gauge; size of sheets, 24 in., 28 in., and 30 in. x 96 in.
g) Sheet, galvanized, Nos. 18, 20, 22, 24, 26, 27, and 28 U.S. gauge; size of sheets, 24 in., 28 in., and 30 in. x 96 in., selected sizes
h) Threaded rods, Nos. 6 to 10, in 12 in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24 in. lengths, selected sizes
Tin
a) Pigs, for casting alloys
b) 1C, 1X, 20 in. x 48 in.
c) 1XX, 20 in. x 48 in.
Washers and Burrs
a) Copper, burrs, Nos. 3 to 14, in 1-lb. boxes
b) Iron burrs, Nos. 3 to 14, in 1-lb. boxes
c) Brass washers, 3/16 in. to ½ in. by 16ths
d) Iron washers, 3/16 in. to ½ in. by 16ths
Welding Fluxes
Welding Rods (all rods come in 24 in. lengths)
a) Brazing, 1/16 in., ⅛ in., and 3/16 in. diameter
b) Cast aluminum, 3/16 in., ¼ in., and ⅜ in. diameter
c) Cast brass, 3/16 in., and ⅜ in. diameter
d) Cast bronze, ¼ in. diameter
e) Cast copper, 3/16 in. and ¼ in. diameter
f) Cast iron, 3/16 in., ¼ in., 5/16 in., and ⅜ in. diameter
g) Low carbon steel, ⅛ in., 3/16 in., and ¼ in. diameter
White Lead — for machine shop
Wire
a) Annealed, 16 to 34 English gauge, selected sizes
b) Coppered market, 5 to 18 English gauge, selected sizes
c) Coppered spring, 2 to 18 English gauge, selected sizes
d) Galvanized, 5 to 18 English gauge, selected sizes
e) Piano, Nos. 00 to 36, selected sizes
f) Tinned, 16 to 24 English gauge, selected sizes
g) Wool, Nos. 0 to 3 in 1-lb. packages, selected sizes
Zinc
a) Pigs, for casting alloys
b) Sheet, Nos. 4 to 14, sheets 36 in. x 84 in.

Shop Safety

Training Safe Workers for Industry

W. H. Cameron

Managing Director,
National Safety Council,
Chicago, Illinois

An important message to the industrial-arts and vocational-education instructor, which ought to be taken to heart.

The need for a knowledge of accident prevention among vocational students goes beyond safety in the school shop itself. Potential industrial employees and students generally need to develop a safety consciousness which will protect them against accidents for the remainder of their lives. Also, they should be prepared to take leadership in safety work when they enter industrial employment.

The need for expert knowledge of organized industrial-accident prevention is indicated by current statistics. Each year, some 18,000 industrial workers are accidentally killed at their jobs; an additional billion and a half are so severely injured that they must either lose considerable time from their work or seek other and new forms of employment because of permanent physical disablement. It is estimated that industrial accidents cost employers and employees over $600,000,000 annually.

Boys and girls who attend vocational schools do so that they may cope to some extent with the existing conditions awaiting them in industry. It is not expected that the student fresh from school will immediately be able to fill the shoes of an experienced journeyman. There are too many "tricks of the trade" which come to the skilled worker only with years of experience. There is, however, a philosophy the school-trained worker can bring to industry, of which many employers are only now beginning to appreciate the economic value.

An expense that employers have always been faced with has been that arising from the training of new and inexperienced men. This, usually, is no small item. Some concerns have estimated that an untrained man is a liability for the first year of his employment. One of the reasons for this is not that the new man's production rating may be particularly low, but that he may do things which will retard the output of other workers. A man in a new environment and not safety minded is always an accident possibility, and accident expenses reach out in many directions.

A large automotive plant in the State of Michigan became so convinced of the importance of guarding against mishaps to its new men that all new employees were made to wear red hats during their first several weeks with the company. The appearance of a red hat in any part of the plant was the sign to a supervisor or to the more seasoned workers to guide the new man in the paths of safety. Giving instructions in what *should* be done was not the problem here; it was in making men understand what *not* to do.

In an investigation by the factory department of the National Safety First Association of Great Britain, it was found

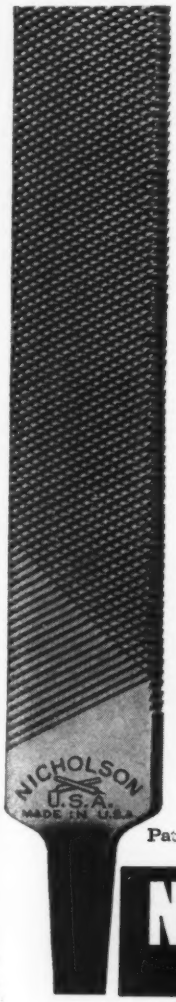
(Continued on page 44A)

For the Woodworking Shop

NICHOLSON
WOOD And CABINET RASPS

The right Nicholson Wood and Cabinet Rasps, in sufficient quantity to make them available to all of your students, will be a big asset to your woodworking shop. These sharp, high-quality tools permit a student to take many short cuts to good work . . . particularly in the shaping of unusual or intricate pieces.

Products of the world's leader in file and rasp manufacture, these Nicholson tools deserve your first consideration when you replenish tool stocks.



For Advanced or Automotive Shop Work

GENUINE NICHOLSON FILES And NICHOLSON X. F. SWISS PATTERN FILES

When you specify files for your metal-working shop, remember that William T. Nicholson pioneered to produce the high-quality machine cut file in 1864 . . . and that Nicholson File Company is making news today with Controlled Serrations*, a new file tooth construction that means faster cutting, longer life, and easier filing. Write "Genuine Nicholson" on your file order and you're sure of getting the best—always.

Nicholson X.F. Swiss Pattern Needle Files are supplied one dozen assorted in a box that becomes a bench stand. Used by industry's most experienced tool and die makers, they handle delicate filing jobs to perfection. Your dealer will supply you. Nicholson File Company, Providence, R. I., U. S. A. Canadian Plant, Port Hope, Ontario.

Patented

A FILE FOR EVERY PURPOSE

NICHOLSON FILE COMPANY

PIONEERS IN QUALITY PRODUCTION

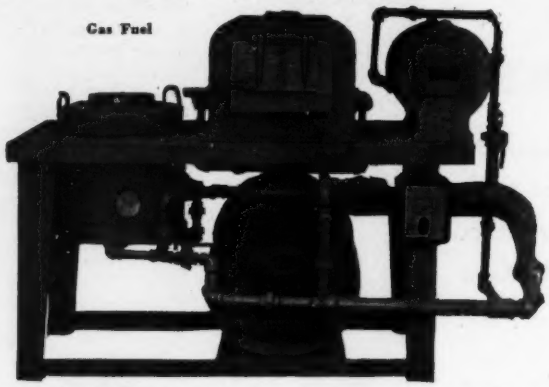
75th ANNIVERSARY YEAR

FURNACES STEWART FORGES

The furnaces and combinations here shown are just several of a variety designed and developed for the school shop

Stewart Triple Purpose Furnaces

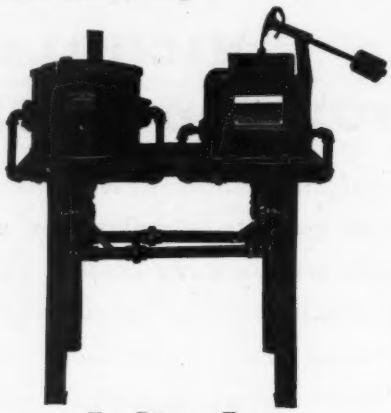
Gas Fuel



These series of combination furnaces are compact and very popular for educational purposes—an assembly of three types of our Stewart Standard Furnaces

Crucible Section
Oven Section
Forge or High Speed Section

These units make a complete plant covering practically the whole range of heat treating. Write for particulars.



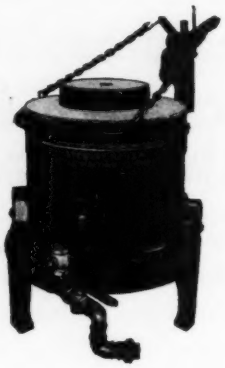
Two Purpose Furnace

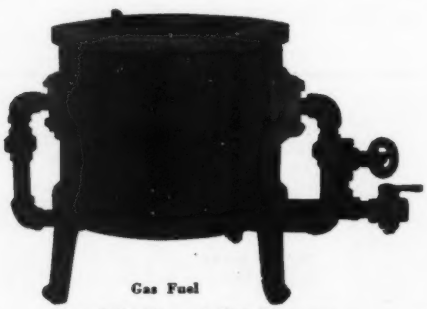
Excellent for lead hardening or other liquid heat hardening. Can be used for melting soft metals. Is fitted with Stewart pressed steel pot 6″ diameter x 6″ deep or 6″ diameter x 8″ deep.

No. 12A Metal Melting Furnace

A sturdy efficient melting furnace having a capacity of 36 lbs. Brass, is fitted with a No. 12 Graphite crucible and lined with first quality refractories. Swinging top made of one piece of molded refractory, banded to add strength, lifts easily from body by means of a special mechanism which swings cover to one side, giving a clear opening into body of furnace.

Floor space.....24″ x 24″
Shipping weight.....435 lbs.



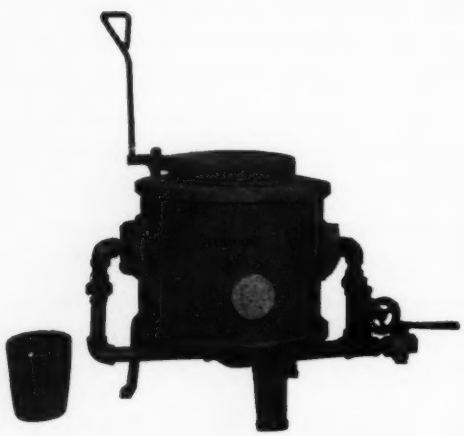


Gas Fuel

No. B68 Round Pot Furnace

This bench type unit is equipped with a 6″ diameter x 8″ deep pressed steel pot for lead or salt hardening. Can also be used for oil tempering. Lined with heavy refractories and fired so that no flame strikes the pot direct.

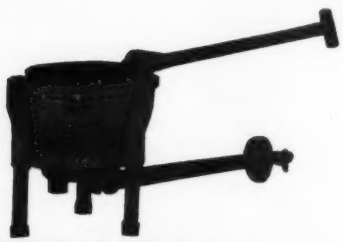
Height .....19″
Bench space .....20″x24″
Shipping weight .....170 lbs.



No. 4A Bench Metal Melting Furnace

This melter is fitted with a No. 4 Graphite crucible, lined with heavy firebrick and fitted with a swinging cover for the melting of brass, copper, and aluminum. Fast, quick heats assured.

Height .....19″
Bench space .....20″ x 24″
Shipping weight .....180 lbs.



No. B40 Bench Soft Metal Melting Furnace

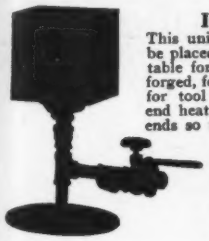
Although small in size, this unit has a capacity of 40 lbs. of lead. Suitable for the melting of any soft metals. Cast Iron shell, lined with insulation, and fitted with a cast iron pot with handle for removing and pouring.

Atmospheric Burner.
Pot.....6″ diameter x 5″ deep
Bench space.....12″ x 20″
Height .....10″
Shipping weight .....55 lbs.

No. 2M Combination Soldering Iron Heater and Melting Pot

A very compact, sturdy and efficient gas heater for Soldering Irons. The flame is projected upward from the bottom and surrounds the irons, heating them rapidly and uniformly. Heavy cast iron body, lined with heavy firebrick. Retains the heat and does not burn out.
Pot on top for melting soft metals.
Will accommodate two 4-lb. irons.

Floor space.....16″ x 11″
Atmospheric or blast burners
Shipping weight.....100 lbs.



No. 152 Forge
Ideal for Small Work

This unit is very handy and one that can be placed conveniently on a bench or small table for the heating of small pieces to be forged, for the heating of rods for bending, for tool dressing, and for the taking of end heats. It has a small opening at both ends so that center heats can be taken or it can be worked from both ends. Ideal where a quick intense heat is required. The top is removable so that a wide variety of work can be handled.

Entrance.....1¼" x 1¼"
Bench space.....12" x 12"
Overall height .....15"
Shipping weight.....60 lbs.

There is a Stewart Furnace for every heat treating requirement.

Ask us for your copy of our Stewart wall chart of S.A.E. steel specification.

SK 248 Forge

A well built forge designed for tool dressing, rod end work, heating for bending, welding, the taking of center heats, and many other purposes where a fast high heat is required. Fitted with air curtain in front to protect the operator and equipped with a proportional gas and air mixer and a quenching tank with rack for tongs.

Opening .....4" wide x 2" high
Heating depth .....8"
Rear opening.....3" diameter
Shipping weight.....450 lbs.

Stewart Standard Ovens

Indirect heat and equipped with a U-shaped hearth slab so that no flame comes in a direct contact with the work. Will handle a wide variety of work, such as annealing, carburizing, tool and die hardening, and general heat treating suitable for temperatures up to 2000 deg. Fahr.

STANDARD SIZES

5" wide x 9" high x 13½" deep and larger

No. 51 Bench High Speed Oven

This small under-fired furnace signed for high speed steel hardening where quick, high heats are essential has a carbofrax U-shaped hearth and no flame can strike the work direct. Suitable for temperatures of 2450 deg. Fahr. Built of Stewart quality throughout.

Opening .....3" high x 5" wide
Heating depth .....6"
Bench space.....20" x 13"
Shipping weight.....200 lbs.

Stewart No. 28 Bench Oven

Here is a very handy furnace for general shop work, lined with heavy first quality refractories and of the under-fired type, for the heat treatment of carbon and high speed steel. Fitted with U-shaped hearth. Adapted to annealing, carburizing, tool and die hardening, and general heat treating.

Opening.....4" high x 8" wide
Heating depth .....12"
Bench space.....24" x 24"
Shipping weight .....550 lbs.

Accredited Representatives and Dealers

J. W. Lazear
11 West 42nd St.
New York City, N Y.

R. C. Sperry
604 Chamber of Commerce Bldg.
Pittsburgh, Pennsylvania

P. R. Gram
510 Everett Street
Lansing, Michigan

Paul Sladky
3906 North 19th St.
Milwaukee, Wisconsin

R. C. Jordan
18th St. and Indiana Ave.
Philadelphia, Penna.

Henry G. Hoss
4801 Park Ave.
Indianapolis, Ind.

Flexible Shaft Co., Ltd.
321 Weston Rd., South
Toronto, Ont., Canada

J. W. Black
19 Sidney Street
East Haven, Conn.

John J. Normoyle Co.
607 Third Ave.
Moline, Ill.

H. F. Fetzer
806 N. Court St.
Rockford, Ill.

Wessendorff. Nelms & Co.
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Houston, Texas

C. W. Piper
4942 Mountgomery Rd.
Norwood, Ohio

Eichman Machinery Co.
Mfrs. Exchange Bldg.
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Brammer Machine & Tool Service Co.
Tulsa, Oklahoma

C. H. Gosiger Machy. Co.
Bacon and McConough Sts.
Dayton, Ohio

H. A. Smith Machy. Co.
Syracuse, New York

Galvin Machy. Sales
500 Brisbane Building
Buffalo, New York

W. W. Wentz
113 Powers Bldg.
Rochester, New York

Chandler Mach. Co.
286 Pryor St., S.W.
Atlanta, Georgia

For complete specifications and catalogs, write

CHICAGO FLEXIBLE SHAFT COMPANY, 5529 W. Roosevelt Road, Chicago, Illinois

Stewart Industrial Furnace Division

Automotive Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Air Compressor
- *a*) 3 to 4 cu. ft., with tank, piping, and motor
- *b*) Small portable, 1 cu. ft., with motor

Aligning Jig — for connecting rods
Anvil
- *a*) No. 100 or No. 125
- *b*) Rim

Armature Growler and Tester
Axle Stands
Battery Equipment
- *a*) Cell tester, panel type with discharge rack
- *b*) Charger (15-battery size) with rack
- *c*) Charger (6-battery size)
- *d*) Gas stove (small)
- *e*) Lead-burning torches, with gauges and piping
- *f*) Plate racks

Bench
- *a*) Electric test, elaborate
- *b*) Electric test, simple
- *c*) Work, with vises
- *d*) Work, portable with vise

Blackboard
Blowtorches — 1-qt. size
Bookcase
Brake
- *a*) Adjusting stand
- *b*) Band-lining machine

Bulletin Board
Cabinets
- *a*) Wood or metal, for bolts and supplies
- *b*) Wood or metal, for filing job sheets and correspondence

Chain Hoist — with overhead trolley and track
Chairs
- *a*) Teacher's
- *b*) For tables, or with tablet arms

Crane — portable
Crankshaft Truing Tool
Creepers
Desk — teacher's
Drill
- *a*) Breast
- *b*) Hand
- *c*) Electric portable, ½ in.
- *d*) Electric portable, ¼ in.
- *e*) Press, 21 in., with motor and chuck

Dynamometer — electric
Forge — with blower and tools
Furnaces — gas
Grease Dispensers
Grinder
- *a*) Cylinder with motor
- *b*) 8 in., with motor
- *c*) 12 in., with motor

Hones — cylinder
Jacks
- *a*) Lever, 1½-ton
- *b*) Floor, roller

Lathe
- *a*) 11 in. x 4 ft., with motor, chucks, and attachments
- *b*) 16 in. x 6 ft., with motor, chucks, and attachments

Press
- *a*) Arbor
- *b*) 30-ton

Spray Painting Outfit
Valve Refacing Machine
Vulcanizer
- *a*) Electric steam for tube work
- *b*) Small, hand

Welding Outfit — with tanks, gauges, and cutting torch
Wheel Alignment
- *a*) Gauge
- *b*) Test table

Automotive Shop—Small Tools

Abrasive — rubstone for cleaning castings in foundry
Alcohol Tester
Battery
- *a*) Cell tester, prod type
- *b*) Cell tester, cadmium
- *c*) Clips, large
- *d*) Element pullers
- *e*) Fillers
- *f*) Funnels, glass
- *g*) Hydrometer, acid
- *h*) Knives
- *j*) Post builders
- *k*) Post drills
- *l*) Post markers
- *m*) Separator trimmer

Bits
- *a*) Expansive
- *b*) Ratchet brace
- *c*) Wood, 3/16 in. to 1 in.

Bolt Cutter — 24 in. and 36 in.
Calipers — 6 in. inside and outside
Cans
- *a*) Oil, 1/3-pt.
- *b*) 1-gal., gas, safety
- *c*) 5-gal., gas, safety
- *d*) 5-gal., kerosene
- *e*) Waste

Checks — tool, 1,000, blank
Chisels
- *a*) Cape, 3/8 in. and 5/8 in.
- *b*) Cold, 3/8 in., 5/8 in., 3/4 in., 1 in.
- *c*) Diamond-point

Combination Squares — 12 in.
Cotter-Pin Extractor
Dividers — 6 in. and 10 in.
Drill Sets
- *a*) 1/32 in. to ½ in., by 64ths
- *b*) ½ in. to 1¼ in., by 32nds

File Cards
File Handles — assorted
Files
- *a*) Flat bastard, 6 in., 8 in., 10 in., and 12 in.
- *b*) Half round, 6 in., 8 in., 10 in., and 12 in.
- *c*) Mill, 6 in., 8 in., 10 in., and 12 in.
- *d*) Round, 6 in., 8 in., 10 in., and 12 in.
- *e*) Square, 8 in., 10 in., and 12 in.

Fire Extinguishers — Pyrene and Acid
First-Aid Cabinet and Supplies
Floor Brushes — 18 in.
Funnels — tin, assorted sizes
Gauges
- *a*) Air pressure
- *b*) Center
- *c*) Depth
- *d*) Thread
- *e*) Thickness

Glass Cutters
Goggles
Grease Guns — plain and pressure-type
Hammers
- *a*) Ball-peen, 4-oz.
- *b*) Ball-peen, 1¼-lb.
- *c*) Ball-peen, 2-lb.
- *d*) Lead
- *e*) Riveting
- *f*) Sledge, No. 12

Ladle
- *a*) 3 in. bowl
- *b*) 6 in. bowl

Lamps — extension, with reels
Lead Pot — gas
Magnet Charger
Meters — volt and ammeter test
Micrometers
- *a*) Outside, 0 to 1 in.
- *b*) Outside, 2 in. to 3 in.
- *c*) Outside, 3 in. to 4 in.
- *d*) Inside, 1½ in. to 6 in.

Molds
- *a*) Battery nut
- *b*) Battery post
- *c*) Battery strap
- *d*) Burning stick
- *e*) Lead hammer

Oilstone
Pipe Taps — ⅛ in., ¼ in., ⅜ in., and ½ in.
Pliers
- *a*) Combination, 6 in.
- *b*) Flat nose
- *c*) Round nose

Pullers
- *a*) Bearing
- *b*) Gear
- *c*) Wheel, hub type

Punches
- *a*) Center
- *b*) Taper pin
- *c*) Blacksmith

Putty Knives
Reamer — splindle bolt
Reamer Sets
- *a*) Piston pin, ½ in. to 1⅜ in.
- *b*) Taper pin
- *c*) Valve seat

Saws
- *a*) Hack, frames, 10 in., adjustable
- *b*) Hack-saw blades, 18, 20, and 24 teeth
- *c*) Hand

Scales
- *a*) Steel, 6 in., graduated 1/64 and 1/100 in.
- *b*) Steel, 12 in., graduated 1/32 in.

Scrapers
- *a*) Bearing
- *b*) Carbon

Screw Drivers
- *a*) 6 in. and 12 in.
- *b*) Small combination

Screw Extractors
Scribers
Snips — tin, 3 in. straight and 3 in., curved
Soldering Coppers — 1-, 2-, and 3-lb. with handles
Spring Spreaders
Stamps
- *a*) Figures, 3/16 in.
- *b*) Letters, 3/16 in.

(Continued on page 44A)

WILLIAMS

SUPERIOR DROP-FORGED TOOLS

HEADQUARTERS FOR WRENCHES

● Williams' is the most complete line of wrenches in the world. In Williams' "Superior" Improved Carbon Steel Wrenches you get just about *twice the strength* of old-fashioned carbon wrenches . . . practically the same strength as the finest alloy wrenches which sell at almost double the price. "Superiors" are made in 50 different patterns—over 1,000 standard sizes.

Whether you need Adjustable, Open-End, Box, Reversible Ratchet, Socket, or Detachable Socket types — ask for "Williams." You simply cannot buy finer tools at any price. Sold by industrial distributors everywhere.

J. H. WILLIAMS & CO., NEW YORK, N. Y.
157 Lafayette St.

We believe that as you plan for new equipment it is to your advantage to investigate the CINCINNATI No.2 Universal L-Type Milling Machine and the CINCINNATI No. 2 Cutter and Tool Grinder. These machines are outstanding and will bring to your school shop the last word in design, safety and ease of operation, and the capacity to handle your milling and cutter sharpening jobs with the highest efficiency.

You will find this equipment is safe and easy to operate for young minds and young muscles. Built into these machines are all of those things which are so essential in the school shop.

May we discuss with you, your shop equipment needs for this coming school year. Our sales representative will be happy to review these machines with you and assist you in the preparation of your specifications and data required in making your proposals for shop equipment. He will also be able to give you helpful information on milling and grinding for use in your machine shop courses.

PRODUCTS FOR YOUR SCHOOL SHOP

CINCINNATI No. 2 L-Type Universal Milling Machine
CINCINNATI No. 2 Universal Tool and Cutter Sharpening Machine
CINCINNATI Standard Attachments for Milling Machines including Universal Dividing Head, Spiral Milling Attachment, Arbors, Adapters, and Cutters.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI, OHIO, U. S. A.
DIRECT SALES OFFICES: Detroit, Cleveland, Chicago, Cincinnati, Pittsburgh
Sales Representatives in Principal Cities

(Continued from page 42A)

Tap-and-Die Sets
- *a*) Machine screw
- *b*) S.A.E. ¼ in. to 1 in.
- *c*) U.S.S. ¼ in. to 1 in.

Tire Tools
Tool Kit — metal box or canvas roll, empty
Twist Drills — (extra sets) selected sizes
Valve
- *a*) Grinders (hand)
- *b*) Spring lifters

Wrenches
- *a*) 8 in., 10 in., 12 in., and 18 in.
- *b*) Ignition sets
- *c*) Pipe, 10 in., 14 in., 16 in., and 18 in.
- *d*) Rim socket
- *e*) Socket sets, large assortment with case
- *f*) Spark plug
- *g*) Speed wrenches
- *h*) Standard end sets, ¼ in. to ⅞ in., U.S.S. and S.A.E.
- *j*) Valve-tappet wrenches

Automotive Shop—Materials and Supplies

Acetylene Gas — in drums, for welding
Acid
Alcohol
Babbitt
Bearing Blue
Bearing Compound
Bolts
- *a*) Machine, selected sizes
- *b*) S.A.E., selected sizes
- *c*) Stove, flat or round heads, selected sizes

Brake Juice — ½-pt. cans
Brushes
- *a*) Paint
- *b*) Spark-plug
- *c*) Spoke
- *d*) Steel
- *e*) Varnish

Chamois
Coil-Spring Assortment
Copper Tubing
Cotter Pins — assorted sizes
Crocus Cloth
Distilled Water
Drain Cocks
Electrolyte
Emery Cloth — Nos. 00, 0, ½, and 1
Enamel — *Auto Painting*
Gaskets
- *a*) Copper asbestos
- *b*) Cork and felt
- *c*) Flange

Gasoline
Grease — cup, cans
Kerosene
Keys, Whitney — assorted
Lacquer — colors
Lead
Lubricant — transmission
Nails and Brads
Nuts
- *a*) S.A.E., castellated, square, hexagon, selected sizes and kinds
- *b*) U.S.S., square and hexagon, selected sizes
- *c*) Machine-screw, selected sizes
- *d*) Wing, selected sizes

Oil
- *a*) Cylinder, light, medium, and heavy
- *b*) 600W
- *c*) Penetrating

Oxygen — in drums for lead burning
Pig Lead
Piston-Ring Compressors
Radiator Hose
Rivets — brake-lining, 5/16 in., ½ in., and ¾ in. long
Sandpaper — Nos. 00, 0, ½ and 1
Screws
- *a*) Flat-head or round-head, iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron or brass, selected sizes and kinds

Sealing Compound
Shellac — ½-pt. cans
Shim Stock
Soapstone
Solder — bar, wire, or self-fluxing wire
Soldering Paste
Spelter — for brazing
Sponges — ½-lb.
Starting Cable
Tacks and Staples — upholstery
Tire
- *a*) Carcass fabric
- *b*) Cushion stock
- *c*) Inner-tube repair stock
- *d*) Patching cement
- *e*) Patches
- *f*) Putty
- *g*) Tread stock
- *h*) Vulcanizing

Valve-Grinding Compound — coarse and fine
Washers
- *a*) Lock, assorted sizes
- *b*) Wrought-iron

Waste
Wire — primary and secondary

(Continued from page 38A)

that 50 per cent of the accidents to girls and 36.5 per cent of the accidents to boys occurred within the first year of their employment on the particular jobs being performed at the time the accidents occurred. Inexperience has always been an important factor in accidental injuries.

Plans for the inclusion of accident prevention in school curriculums will necessarily consider first the hazards of immediate environment. The dangers in the school shop will be the most obvious. One of the best ways to teach accident prevention in a school shop is to have the students carry on a safety program much as it would be carried on in an industrial plant.

In every industrial concern of importance, there is today some kind of a safety program. This will generally include safety committees to direct the work. There will be inspections for unsafe practices and unsafe conditions. There will also be accident investigations, reports, summaries, and a listing of necessary recommendations for the removal of specific hazards.

Safety work of a more general nature will include posters, suitably mounted on prominently placed bulletin boards; meetings of students for safety lectures, preferably by men from outside industry; motion pictures or film strips; and visits to local industrial plants.

Accident-prevention work produces best results when a definite plan or program is followed. The plan should be based on the facts of accident occurrence, for in accident prevention, probably more than anywhere else, past experience reflects future occurrences. Possibly all desirable safety habits are based on the facts found in accident records.

Useful information may be derived from accidents which occur in the shop department, although for a single school, these accidents may be few. Accident causes in any one school, however, may be anticipated through the cumulative experience of other school shops.[1]

Accident investigating and reporting has been one of the weak points in industrial safety programs. The report forms in use are frequently confusing in their accident-cause classification. Prevention work must necessarily be based largely upon cause data developed through accident reports and inspections, and unless these reports are clear and accurate, summaries will be confusing and the safety program less effective. The vocational student who is thoroughly grounded in safety organization methods can fill an important place in any industrial establishment.

The principles of machine guarding, too, can be taught more easily in a vocational school than picked up later when the student has become a plant worker. While working under an instructor, the student has a better perspective of industry as a whole than he will have later when, as an employee, he is engaged in personally assigned tasks.

There are comparatively few possible types of point-of-operation guards. In school training, these types can be memorized with little effort. The man on the job, uninformed, may never know when he has exhausted all possibilities for guarding an operation of some particular machine. Power transmission equipment should be guarded according to definite standards. It is not difficult for the instructor to make these known to those under his care, and the information may prove of considerable value.

Employers hope for something even more from the vocational-school student than the ability to care for his own safety alone. They are looking for leadership by which to improve industrial safety work generally.

Because of the infrequency of severe accidents in individual schools and school shops, it has been difficult sometimes to arouse interest in safety programs. When it is realized how valuable this training may be to the worker later on, more attention will undoubtedly be given to safety training.

(Turn to page 46A)

[1] See "Safety Training for Vocational Schools and School Shops" published by the National Safety Council, Chicago, Ill.

Spin Metal

INTO BEAUTIFUL, USEFUL ARTICLES . . . IT'S INTERESTING, INSTRUCTIVE

You would marvel at the lovely objects students of Mr. H. M. Dexter (Grand Rapids Central High School) spin from metal. Cups, vases, trays, etc., from copper, bronze, Brittania, German silver and other sheet metals. With an "Oliver" Metal Spinning Lathe your students, too, can produce useful, beautiful articles. This lathe is very smooth and easy running. Has adjustable speed motor-headstock, live tail center, extra heavy bearings. Also fine for turning metal and wood.

WRITE FOR ILLUSTRATED BULLETIN

OLIVER MACHINERY CO., GRAND RAPIDS, MICH.

ART METAL and JEWELRY WORK EQUIPMENTS and SUPPLIES

We make a specialty of equipping and supplying schools, clubs and summer camps for this work and carry all kinds of materials used, including gold, silver, copper, brass, pewter aluminum and nickel silver, in sheet and wire form, and semi-precious stones.

"Rose" anvils and hammers.

The first to be used in school work. Beware of inferior substitutes. **Specify "Rose"** when ordering.

We take pride in our reputation for service. No order or request too small to receive our prompt and careful attention.

Our Brochure "The Metal Crafts" is full of helpful suggestions. Sample copy sent free. Subscription price for three issues, 50c. **Send $1.00** for our new portfolio of 20 plates. "Things in Metal" including 350 designs.

Our new catalog is in preparation. If interested ask for publication details.

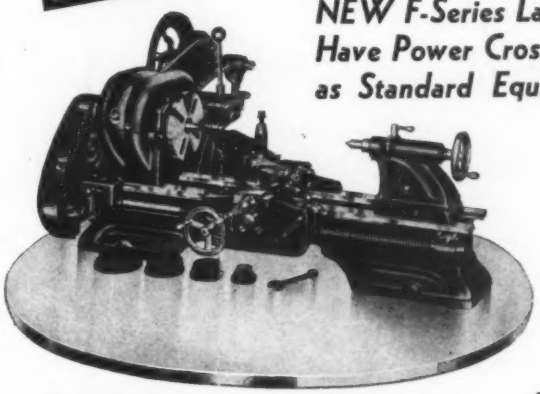
Metal Crafts Supply Co.

37 Aborn St., Providence, R. I.

NEW Atlas PRECISION TOOLS MATCH THE NEEDS OF MODERN EDUCATION

SHOP INSTRUCTORS EVERYWHERE endorse this idea! Increasing numbers of them—instead of investing a large amount in one machine—are specifying two or more Atlas tools to give more students better opportunities to "learn by doing." Atlas automotive-type line production methods make it possible to secure rugged, dependable, precision power tools at a fraction of their former cost.

NEW F-Series Lathes Have Power Cross Feed as Standard Equipment!



Here, for the first time, is a low cost precision lathe with instantly reversible automatic power cross feed and longitudinal feed as standard equipment. It's rugged, accurate, powerful—has complete V-belt drive, quick-change countershafts, compact controls, precision-ground bed ways, custom-built spindle bearings, back-geared power, and many other modern features. Prices, complete less motor, are $104.75 for horizontal countershaft, $99.75 for vertical countershaft. Ask your dealer for a working demonstration.

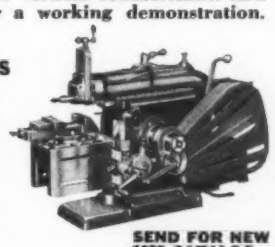
Drill Presses

New features this year include adjustable feed return, column collar, and new accessories. 4 sizes to meet all needs, see catalog.

Precision

BENCH SHAPERS

Shaping instruction has been added to the shop courses of many schools now that this low cost 7" Atlas Shaper is available. Has 4 speeds, 5 surface feeds, and exceptionally rugged construction. $215, complete with Safety Guards less motor.



SEND FOR NEW 1939 CATALOG

ATLAS PRESS CO.

371 N. Pitcher Street

Kalamazoo, Mich.

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ARBOR PRESSES · SHAPERS

If it has a door, lid, or secret panel—

use this hinge and get:

- A closer fit.
- Greater safety.
- Enhanced beauty.
- Less trouble.
- No polishing.

Write for catalag today.

Soss Manufacturing Co.
656 E. First Ave. Roselle, N. J. Pat.

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NEVER SEEN • NEVER HEARD • NEVER SAG • NEVER TROUBLE

Three Solutions to Your Gluing Problems

No. 30 No. 600 No. 14

A trio of glues, each one the standard in its field

SEND FOR THESE

NEW—"Do's and Don'ts For Gluing," a sample job plan and "Glue Facts" for your shop instruction Bulletin Board.

LEPAGE'S ADHESIVES
Department A
GLOUCESTER, MASS.

Safety Rules for Millroom

E. Pieri

Junior and Senior High School,
Fort Bragg, California

A set of rules to insure the safe operation of woodworking machinery.

The following general safety rules apply to the conduct of the students in the shop and the operation of all machines and must be observed by the students *at all times* while using woodworking tools and machines.

These rules are given to eliminate avoidable accidents and are for the operator's protection. The safety-first signs have been posted in the shop as warnings and to make the student safety conscious.

General Safety Rules

1. Students are warned not to use the woodworking machines until they have received proper safety instruction by the shop teacher, and the student must ask for further instruction if in doubt concerning any operation.

2. All safety guards must be kept in proper position while machines are being operated.

3. Machines must not be operated while instructor is out of room.

4. All adjustments must be made and everything securely fastened before power is turned on.

5. All "setups" must be checked by instructor before power is turned on.

6. All wrenches and other tools must be removed from machine before power is turned on.

7. Machine must be allowed to come to a dead stop before any adjustments are made.

8. When making special setups students should be sure that all clamps are securely fastened. Instructor must check all setups before machine is started.

9. Loose neckties, loose sleeves, loose aprons, and the like, must be securely fastened or removed before operating machines.

10. Boys not operating machines must stay outside of the white safety lines painted on the floor.

11. Students must not distract attention of boys using machines. Students operating machines must not allow their attention to be diverted while at work.

12. If, while operating a machine, a student finds it out of adjustment, he will immediately report to instructor, instead of attempting to use the machine while out of adjustment.

13. Floor around machine must be kept clear of scraps of lumber. Small waste pieces should be put in scrap box.

14. Power should always be shut off after the machine has been used.

15. Great care must be taken to see that all lumber is free of nails, sand, paint or loose knots before being machined.

16. Stock must never be forced into a machine faster than it will cut.

17. Machines should not be used for trivial operations, especially on small pieces of lumber. Instructor's O.K. should be secured before turning on the power.

18. "Horseplay" is absolutely forbidden in the millroom.

19. No student should start or stop a machine for another student.

20. The operator must see that all students are clear of the machine before turning on power.

21. Students operating a power saw must not permit their fingers to come closer than 3 in. from saw.

22. Students using hand tools should always use them properly.

(Continued on page 51A)

EVERY SHOP INSTRUCTOR SHOULD HAVE THIS

GUIDE OF ENVELOPE INFORMATION

Current information covering all envelopes — commercial, coin, catalog, bankers flap, clasp, collection, baronial, window and many other styles are illustrated with examples to show how costs are computed.

FOR A CLASS PROJECT

An interesting problem for a class project would be a study of the envelopes used in your various school departments. Are they the proper type, style and grade for the job? We would be glad to assist in every way possible as envelope requirements for school systems are a specialty with us.

SEND FOR THIS GUIDE OF ENVELOPE INFORMATION

Containing the listing of items noted above covering over 700 stock items and a cumulative stock of over 25,000,000 envelopes. This book should be in your file—Just send a card with your name, your school and department, and our Guide Book, Packet and "Envelope of the Month" complete series will be sent WITHOUT CHARGE.

YOURS FOR THE ASKING

WESTERN STATES ENVELOPE CO.

1616 West Pierce St.
Milwaukee, Wis.

(Continued from page 46A)

23. When chipping or hammering metals, students should wear goggles to protect their eyes.

24. If a student receives an injury of any kind, he must report it to the instructor at once.

Safety Instruction for Circular Saw

1. The top guard must be kept down over the saw while machine is being operated.

2. The saw must not be raised above the table more than absolutely necessary to make the cut.

3. A push stick must be used when ripping narrow pieces of lumber.

4. The clearance block must be screwed to fence when cutting off short pieces of stock.

5. Fence must not be adjusted until saw is at a dead stop.

6. Fingers must be kept clear of track of saw, and hand never allowed to cross saw line while machine is in operation.

7. Circular-saw switch must be pulled at box before dado head is put on.

8. All special setups and dado heads must be inspected by instructor before power is turned on.

9. Students must never attempt to clear away scrap close to the saw with their fingers. If necessary, push away these scraps with a stick about 2 ft. long.

10. The dado head must be taken off saw arbor after use.

11. When helping to "tail-off" the saw, students must never pull on a board being ripped. They should hold board up and allow operator to push stock through saw.

12. Resawing must not be done on circular saw without special permission of the instructor.

13. Cylindrical stock must not be cut on circular saw.

14. Students must never lower pieces of stock down over the saw. This operation is sometimes performed when cutting holes in rails for drawer fronts. Special permission should be obtained from the instructor for doing this type of work.

15. Ripping stock without using the ripping fence or cross-cutting stock without using the sliding cross-cutting fence is extremely dangerous, and is absolutely forbidden. This rule applies also to dado-head work.

16. Students cutting tenons on the circular saw must hold the material firmly with the thumb on the board and the fingers over the ripping fence.

Safety Instructions for Jointer

1. Guard must be kept over knives at all times while jointer is being operated.

2. The depth of the cut must be adjusted before power is turned on.

3. Jointer must not be used for stock less than 12 in. long.

4. Push stick must be used when jointing narrow or flat pieces of stock.

5. The jointer must not be used for stock less than 1 in. wide.

6. The flat side of a piece of stock must not run over jointer without special permission of the instructor.

7. Setups on jointer for special operations such as beveling, tapering, etc., must be checked by instructor before power is turned on.

8. All special setups on the jointer must be inspected by the instructor before power is turned on.

9. The end grain of a piece of stock must never be run over the jointer.

10. The jointer must not be used for cuts heavier than ⅛ in. without special permission from the instructor.

11. When tapering a piece of stock on the jointer, a block of wood must be clamped to the fence or feed table to prevent the piece being tapered from flying back, always use a push stick and cut slowly.

12. Never tamper with adjustment wheel on the back end of jointer. If jointer is out of adjustment, ask the instructor to adjust it.

Band Saw

1. The saw guide must be adjusted

(Continued on page 54A)

Printshop Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Bellows
- *a)* Hand, small size
- *b)* Electric, blower type

Blackboard — permanent or portable

Bookcase — for reference books, catalogs, etc., sectional preferable

Brayer — 6 in. or 8 in., for proofing

Brushes
- *a)* Bench
- *b)* Benzine, No. 1, oval black
- *c)* Floor
- *d)* Padding, 1½ in. wide

Bulletin Board

Cabinets
- *a)* Galley, for double-column, wood or steel, four tiers (to be used with typesetting machines)
- *b)* Galley, for 8¾ in. by 13 in. galleys, wood or steel, four tiers
- *c)* Ink and roller, to accommodate platen-press rollers, wood or steel
- *d)* Matrix, for use with typesetting machines only
- *e)* Roller, cabinet or rack for cylinder rollers
- *f)* Supply, for leads, slugs, spaces, strip material, with top for lead cutter and mitering machine
- *g)* Type, school-type, each to accommodate two California cases, job cases, case slides, galley slide, and copy holder
- *h)* Type, complete with 24 full-size California job cases, with overhead lead-and-slug cases, wood
- *j)* Type, complete with 24 full-size California job cases, double work bank, wood or steel
- *k)* Wood or metal, for filing class records, instruction sheets, etc.

Cans
- *a)* Benzine, pint-size
- *b)* Benzine, 5-gal. size
- *c)* Kerosene, safety, 1-gal. size
- *d)* Waste can, fireproof, for rags

Cases
- *a)* Blank, full-size, to accommodate ¼-size cases
- *b)* Border, ¼-size, for ornamental borders
- *c)* Lead and slug, regular-size, to hold labor-saving fonts of leads and slugs
- *d)* Metal furniture, to hold labor-saving fonts
- *e)* Rule, ¼-size, for brass rule

Chairs — teacher's and tablet-arm

Chase Racks
- *a)* For platen presses
- *b)* For cylinder presses

Chases
- *a)* For each size of platen press
- *b)* For cylinder press

Composing Sticks — 6 in. x 2 in., 8 in. x 2 in., 12 in. x 2 in., and 18 x 2 in., adjustable

Cutter
- *a)* Lead and rule
- *b)* Paper, lever-type, 20 in., with pedestal. Should handle 20 in. x 26 in. sheet
- *c)* Paper, lever-type, 26 in. or 30 in.
- *d)* Paper, lever-type, 30 in., with divided back gauge
- *e)* 30 in. to 36 in. power cutter

Desk — teacher's, with drawer compartments

Drying Racks
- *a)* Combination drying rack and stock table for platen presses, 30 trays
- *b)* Trays, interlocking, for cylinder press

Folding Bones — for hand folding

Folding Machine — 20 in. x 26 in. size, 4-fold, two parallel and two right-angle folds, power

Furniture — iron, 2 x 4 to 10 x 15 picas

Galleys — Steel, 8¾ in. x 13 in., 6¼ in. x 23½ in., double column, and 12 in. x 18 in.

Gauge Pins — spring-tongue

Glue Pot — electric, 1-qt. size

Imposing Tables
- *a)* 12 in. x 18 in., with iron top, including reglets and furniture
- *b)* 24 in. x 36 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *c)* 36 in. x 48 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *d)* 39 in. x 63 in., with iron top, complete drawers, letter boards, reglets, and furniture

Ink Fountains
- *a)* Short, for 8 x 12, 10 x 15, and 12 x 18 presses
- *b)* Long, for 10 x 15, and 12 x 18 presses

Knives
- *a)* Overlay, for make-ready
- *b)* Ink, 6 in. and 8 in.
- *c)* Ink, 8 in., square end

Leader Boxes

Leaders
- *a)* 6-pt., 8-pt., and 10-pt., fine dot
- *b)* 8-pt. and 10-pt. hyphen

Line Gauges
- *a)* Metal, brass, or steel
- *b)* Wood

Metal Furnace — for recasting and refining type metal, used only with typesetting machines

Mitering Machine

Numbering Machines
- *a)* For use on presses
- *b)* Hand machines

Ornaments
- *a)* Assorted floral and decorative designs
- *b)* Border, 6-pt. and 12-pt., decorative

Perforator
- *a)* 24 in., foot treadle
- *b)* 28 in., foot treadle

Planer
- *a)* Mallets, hickory or fiber
- *b)* Proof, maple, with felt bottom
- *c)* Type, maple, with leather top

Presses
- *a)* Cylinder, two-revolution, four-roller, 25 x 38, complete with variable-speed motor, cast rollers, etc.
- *b)* Platen, 8 x 12, with foot treadle, counter, flywheel guard, platen guard, brake, and set of cast rollers (motor and treadle combination if desired)
- *c)* Platen, 10 x 15, complete with variable-speed motor, counter, flywheel guard, brake, and set of cast rollers, etc.
- *d)* Platen, 12 x 18, complete with variable-speed motors, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc.
- *e)* Proof, 14 x 18, with cabinet
- *f)* Proof, 20 x 24, with cabinet

Punch
- *a)* Foot-power, multiple, with assorted punches
- *b)* Lever, two-die, with assorted punches
- *c)* Power, multiple, with assorted punches (paper drill may be substituted)

Quoins
- *a)* Sizes No. 1 and No. 2
- *b)* Keys, Sizes No. 1 and No. 2

Rule — plain and brass (fonts to fit quarter cases)
- *a)* 2-pt., labor-saving, hair-line, side face
- *b)* 2-pt., labor-saving, 1-pt. side face
- *c)* 1-pt., labor-saving, 1-pt. face
- *d)* 2-pt., labor-saving, double face

Saw Trimmers — pedestal type, with point gauge, and raising and lowering table

Spacing Material
- *a)* Iron furniture, as selected
- *b)* Leads, labor-saving, 2-pt.
- *c)* Leads, 2-ft. strips, 2-pt.
- *d)* Slugs, labor-saving, 6-pt.
- *e)* Slugs, 2-ft. strips, 6-pt.
- *f)* Spaces and quads
- *g)* Thin spaces, brass and copper, assorted sizes, 6 to 8 pt., one size in each box

Specimen Display Board

Staple Binder — pedestal-type, foot power

Stitcher — wire, power, capacity ½ in. or ¾ in., flat and saddle-back tables

Tweezers — 3½ in.

Tympan Paper (with combination holder and cutter)
- *a)* 18 in.
- *b)* 38 in., upright, to be used with cylinder press only

Type
- *a)* Body, lightface — 8 and 10 pt.
- *b)* Job lightface — 6, 8, 10, 12, 14, 18, 24, 30, 36, and 48 pt.
- *c)* Job, lightface italics — 8, 10, 12, 14, 18, 24, and 36 pt.
- *d)* Job, boldface — 6 and 8 pt.; 12 pt.; No. 26; 12-pt. No. 27; 12-pt., No. 28; 18-pt., No. 30
- *e)* Job, light copperplate Gothic — 6 pt. Nos. 1, 2, 3, 4; 12 pt., Nos. 5, 6, 7, 8
- *f)* Job, condensed title Gothic — 12, 18, 24, 36, 48, 60, and 72 pt.
- *g)* Job, text type — 10, 12, 14, 18, and 24 pt.
- *h)* Job, typewriter type — 12 pt. with spaces
- *j)* Job, boldface italic — 8, 10, 12, 14, 18, 24, 30 and 36 pt.
- *k)* Job, heavy copperplate Gothic — 6 pt., Nos. 21, 22, 23, and 24; 12 pt., No. 25
- *l)* Wood, condensed Gothic — 8, 12, 15 and 18 line

Typesetting Machines
- *a)* Either linotype or intertype, 2 or 3 magazines, and molds
- *b)* Matrices for same, 6-, 8-, 10-, and 12-point, as selected

Supplies

Benzine or Gasoline — for cleaning type or presses

Bindery Tape — 2 in. wide, brown or black

Gold Bronze — pale

Ink
- *a)* Bond, black, for bond papers
- *b)* Book, black, for school paper, etc.
- *c)* Cover, colors as selected
- *d)* Dryers and compounds, as selected
- *e)* Halftone, black
- *f)* Job, colors as selected

(Continued on page 54A)

Simplicity, Safety, Precision and Speed

are embodied in all of our manufacture.

Safety is built into C&G Saw Trimmers. Saw blade guards and emery wheel guards cover as much of the moving parts as possible. Work is clamped into the saw safely with a super-safe clamp and is placed into the clamp while at an extreme position from the blade. We do not encourage carelessness, but C&G Saw Trimmers are safe even against careless operation.

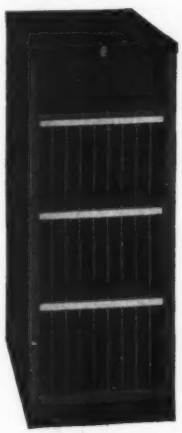
C&G No. 3-A Deluxe Model Saw Trimmers assure efficient and safe handling of the many types of sawing now demanded in modern typography. Plain straight sawing, difficult angle work, odd indentions, removing base from display slugs, are all easy to handle on this versatile machine. You can purchase it with just the right equipment to handle your particular requirements.

C&G No. 2 Pedestal Model Saw Trimmers are fast and accurate. Parts replacement is negligible, and cost of operation confined almost exclusively to the actual power required to run machine. Hundreds of this model in use throughout the United States and foreign countries in newspaper composing rooms, trade plants and commercial offices, and every user a satisfied one.

C&G Router, Jigsaw and Typehigh was designed to handle plate changes and corrections. You can drill, route high spots, change key numbers, notch, mortise either outside or inside, and finish cuts to exact type-high. The latter operation alone will save many hours of makeready time. For those who have but infrequent use for a jigsaw, we now make separately the router end of this machine.

C&G Strip Material Cabinet — Every saw trimmer owner can use this cabinet to advantage. Speeds production, places strip material where it belongs. Built of heavy sheet steel, height 34", length 24½", width 13". Holds over 2000 pounds of metal and can be used with any saw trimmer. Top makes convenient work bench, and opening at top can be used for tools, or additional strip and basing material.

C&G Waste Receptacles — No. 20, 16" high, 16" long, 11" wide, and the handle swivels to a height of 26". Made of heavy sheet steel, has capacity of 1467 cubic inches. No. 21, 14" high, 19" long, 13½" wide; made of same material as the No. 20; capacity 2000 cubic inches. Back wall from which handle projects is 16" high, and handle swivels to height of 26". The No. 20 is regular equipment with the No. 3-A C&G Saw Trimmer.



No. 22 Strip Material Cabinet

No. 20 Waste Receptacle

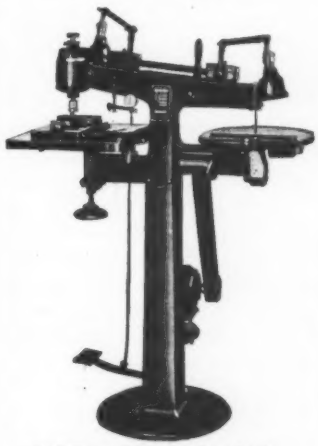
No. 21 Waste Receptacle

Adequate light where needed

C&G No. 3-A Deluxe Model

Safe Against Even Careless Operation.

C&G No. 2—Pedestal Model



C&G Router, Jigsaw Typehigh

Descriptive literature upon request.

MILWAUKEE SAW TRIMMER CORPORATION

610-612 East Clybourn Street **Milwaukee, Wisconsin**

(Continued from page 52A)

g) Metallic, gold and silver
h) Process, black, red, yellow, blue

Kerosene — for cleaning rollers

Padding Cement
a) Cold
b) Hot

Paper
a) Bond, fine grade, 17 x 22 — 20, white
b) Bond, medium grade, 17 x 22 — 20, white
c) Bond, sulphite, 17 x 22 — 20, white
d) Bond, sulphite, 17 x 22 — 20, colors as selected
e) Book, enamel, 25 x 38 — 80, white
f) Book, machine finish, 25 x 38 — 80, white
g) Book, eggshell finish, 25 x 38 — 60, white
h) Cover, as selected, 20 x 26, medium
j) Card Bristol, fine grade, 22 x 28 — 4-ply, white
k) Index Bristol, medium grade, 25½ x 30½ — 110, white
l) Index Bristol, medium grade, 25½ x 30½ — 140, white
m) Mill Bristol, medium grade, 25½ x 30½ — 140, colors as selected
n) Pressboard, red
o) Strawboard, No. 40 or No. 50
p) Tagboard, manila, 24 x 36 — 140
q) Tympan, to fit presses
r) Wrapping paper, size as selected
s) Holder for same

Paste
a) Bindery
b) Make-ready

Twine — cotton, for tying jobs

Wire Stitching
a) No. 25 round wire for stitcher
b) Wire staples, ¼ in.

(Continued from page 51A)

within ½ in. of stock to be cut, before power is turned on.

2. Students must not allow their fingers to come closer than 2 in. to saw when cutting stock.

3. Students must not allow their hands to cross the saw line when operating band saw.

4. Students must not stand at right-hand side of band-saw machine. A serious accident might result if saw should break.

5. If necessary to back saw out of a long cut, power should first be turned off and machine allowed to come to a dead stop.

6. A curve of small radius should not be cut except with a very narrow band saw.

7. Cylindrical stock must never be cut on band saw.

8. The guide must not be adjusted while the band saw is in motion.

9. Stock must not be cut on the band saw unless such material is firmly supported against the downward thrust of the saw.

10. If band saw should break while machine is in operation, student will immediately shut off power, keep clear of saw and notify instructor.

11. When sawing out a design, cut into sharp corners first before sawing around curves that approach the corner, otherwise backing around a curve would be necessary with the resulting danger of pulling off the saw.

Mortiser

1. Before power is turned on, the downward travel of the hollow chisel and the height of the table must be adjusted so that the bit at the bottom of its stroke will not strike the table.

2. Stock must be firmly clamped in machine before being mortised.

3. The stock must be moved sideways the width of the chisel between each cut.

4. The sliding table must not be moved until bit is clear of mortise.

5. When mortising hardwood, the hollow chisel must not be forced into the stock faster than it will cut. The bit should be oiled if it makes a noise while running.

Wood-Turning Lathes

1. Students must not wear loose sleeves or neckties while operating wood-turning lathe.

2. All wood intended for turning must be carefully examined for checks, knots or other defects before being put in lathe.

3. All glued work must be properly set before being turned in lathe.

4. Rough stock must be turned a few times by hand after being centered in the lathe to make sure it will clear tool rest; dead center must be oiled before power is turned on.

5. All turning tools must be held firmly in both hands while cutting stock in lathe.

6. All lathe jobs must be started at the lowest speed and stock must be roughed down to cylindrical form before a higher speed is used.

7. Great care must be taken to prevent turning tools catching in wood while using lathe.

8. The lathe must be stopped before a caliper is used to determine diameter of stock, unless work is already turned to a smooth cylinder.

9. The tool rest must be kept as close as possible to the stock being turned, but must not be adjusted until lathe is stopped.

10. The belt must not be shifted from one pulley to another while the lathe is running.

11. Large diameter stock must never be turned at high speed.

12. Faceplate work must be securely screwed to faceplate before being turned, and great care must be taken when turning to avoid cutting too deep and striking screws.

13. The gouge should not be used in cutting the inside of a cup-shaped faceplate job.

14. Care must be taken to avoid burning lathe tools by taking too heavy a cut or scraping too long on a surface.

15. The tailstock must be securely locked before lathe is started.

16. Wood-turning tools only may be used for lathe work.

17. The tool rest must be removed from the holder before sanding.

Grinder

1. Students must wear goggles while using grinder.

Safety Instructions for Belt Sander

1. The belt sander is intended for quantity production work and must not be used for sanding small pieces of stock.

Safety Instructions for Disk Sander

1. Before turning on power, be sure that table is set about ¼ in. from sandpaper disk and all adjustments are properly locked.

2. Check to see that sandpaper is securely fastened on disk before turning on power.

3. Apply work only to the part of the sandpaper disk that is traveling downward.

4. Do not attempt to sandpaper small pieces of wood where there is danger of allowing the fingers to come in contact with the abrasive surface.

Safety Instructions for Electric Drill Press, Shaper and Router

1. Students must have special permission from instructor before using the electric drill press, shaper or router.

2. Remove cord from electric power socket before changing bits or cutters or making adjustments. Be sure that switch on motor is turned off before putting plug in socket.

3. When machine is set up ready for use, check to see that all adjustments are securely fastened and get instructor's permission before beginning work.

4. When operating shaper or router, always hold stock with both hands and do not force the cutter through the stock faster than it will cut.

Safety Instructions for Wood Finishing

1. A spray gun must never be used in a closed room.

2. Wood-finishing materials must always be kept away from an open flame.

(*To be filled out by the student*)

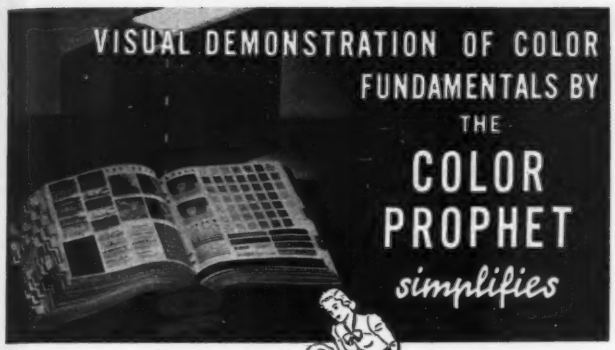
I have carefully read and fully understand all the foregoing safety rules regarding the operation of dangerous woodworking machinery.

I hereby promise to observe these rules at all times while enrolled as a student in the woodworking department of..... High School.

Date.....

Signed .....

(Turn to page 58A)



ART AND PRINTING INSTRUCTION

They'll understand you now on the subject of color, and the results of color. This new visual method is so easy to understand that even students of eight can instantly and fully comprehend it . . . and yet, the method is so accurate that advertisers, artists, printers, lithographers, engravers, and ink manufacturers rely on its use daily to solve their most difficult color problems.

This literal library of color shows 176 color combinations, over 12,000 color variations, and 32 type faces, both body and display. It also gives a comprehensive knowledge of engraving, by showing color results in screens, Ben Days and solids.

The Color Prophet has over 700 loose-leaf pages, bound under a metal cover with colored celluloid index tabs. The Color Prophet has been recommended as a necessity for color instruction in all the schools of one of the largest school board systems in the United States. Invaluable to every art and printing instructor who desires a positive illustrated source of proved color combinations and color applications.

LITERATURE UPON REQUEST

THE COLOR PROPHET SALES CO.

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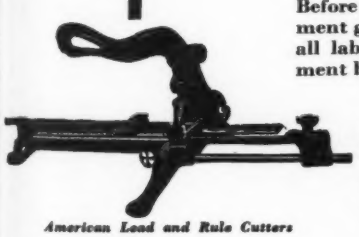
Specify

Rouse TOOLS FOR YOUR PRINT SHOP



American Lead and Rule Cutters

Before you buy Print Shop Equipment get complete information on all labor-saving tools and equipment by H. B. Rouse & Company.

More than 37 years of manufacturing equipment for printers has made Rouse labor-saving devices the standard of the world for efficiency and accuracy.

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When teaching accuracy take no chances with inaccurate equipment. Be sure by specifying Rouse. Write for prices and circulars.

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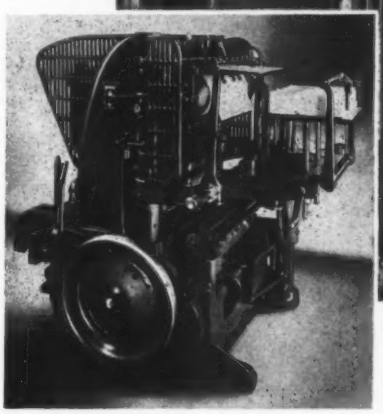

MIEHLE VERTICAL

SIMPLE • COMPACT • PRACTICAL

Modern construction is simple in design . . . compact . . . practical. THE MIEHLE VERTICAL, automatic job press with cylinder and bed moving up and down, handles a great variety of work.

The MIEHLE VERTICAL will produce any job within its range more effectively and more economically than any other press. Simple adjustments, safety features and complete accessibility make it easy to operate. It is standard equipment in thousands of shops throughout the country.

Sheet sizes 3¼x5½ to 13½x20 inches.
Speed range per hour, 2500 to 4500.

Motored by KIMBLE

MIEHLE PRINTING PRESS & MFG. CO.

CHICAGO NEW YORK

SALES OFFICES IN PRINCIPAL CITIES

IT PAYS TO PRINT IT ON A MIEHLE

Electrical-Shop Equipment, Supplies, and Motor and Testing Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets

Bench Grinder
Benches — plain or with drawers, for tools and equipment, or with compartments for the storing of wiring panels. Preferably they should have electrical outlets
Bits
a) Auger, ¼ in. to 1 in. by 16ths
b) Auger, 11/16 in., 18 in. long
c) Drill, for wood, square shank, ⅛ in. to ½ in., by 16ths
d) Expansion
e) Extension, 18 in.
f) Screw-driver, ¼ in.
Blackboard — permanent or portable
Blowtorches — 1 qt. size
Bookcase
Braces — ratchet-type, 8 in. swing
Bulletin Board
Cabinets — wood or metal, for filing class records, instruction sheets, drawings, etc.
Chairs — teacher's and tablet-arm
Compass Saw
Coil
a) Spreader
b) Taper
c) Winder
Desk — teacher's, with drawer compartments
Drill
a) Breast
b) Concrete, ⅜ in., ½ in., ¾ in., 1 in.
c) Hand
d) Portable, electric
e) Twist, 1/32 in. to ⅜ in. by 32nds
Drill Press
a) Bench, hand or power driven
b) Heavy, power driven
Files
First-Aid Cabinet and Supplies
Hack Saw
a) Blades, 10 in., 24-tooth
b) Frames, adjustable
Hammers
a) Claw, 12-oz.
b) Machinists', ball-peen
Hickey — ½ in. and ¾ in.
Lathe
a) Engine, 10 in. or 12 in. swing, 6 ft. or 8 ft. long
b) Speed
Pliers
a) Gas, 6½ in. and 8 in.
b) Side-cutting, 6 in.
Punch — for metal molding
Punches — assorted
Reamers
a) Pipe burring, ¼ in. to 1 in.
b) Pipe burring, ½ in. to 2 in.
Rules
a) 48 in. zigzag
b) 72 in. zigzag
Screw Drivers — 3 in., 5 in., and 8 in.
Shears — for cutting metal molding
Solder Dippers
Soldering Coppers
a) Assorted
b) Electric
c) Handles
Stocks and Dies — for pipe threads, ½ in. to 1 in.
Vises
a) Machinists', 4 in.
b) Pipe
Wrenches
a) Adjustable, 6 in. and 8 in.
b) Pipe, 10 in., 12 in., and 14 in.
c) Socket, combination

Electrical Shop—Supplies

Abrasive Cloth — Aluminum oxide. 1, 1½, and 2 in. wide
Armored Cable
a) 2-wire, No. 14, single-strip
b) 3-wire, No. 14, single-strip
c) Box connectors
Attachment Plug
Bar Hangers
Batteries — dry cells
Battery Acid — 1.300
Battery Sealing Compound
Box Cleats
Brads — ¾ in., No. 19, and 1½ in., No. 16
Brake Lining — ¼ in. x 2 in.
Brushes — carbon, for motors and generators
Burglar Contacts
a) Open-circuit
b) Closed-circuit
Bushings
a) Loom, No. 1 and No. 2
b) "Jiffy" loom No. 2
Buzzers
Cleats — unglazed porcelain, 2-wire
Clips — test, with insulators, Universal, Nos. 22, 23, 24 and 25
Commutator Cement
Conduit
a) Bushings, ½ in., ¾ in., and 1 in.
b) Box connectors, for flexible
c) Couplings, for flexible
d) Lock nuts, ½ in., ¾ in., and 1 in.
e) Rigid, ½ in., ¾ in., and 1 in.
Condulet
a) Fillings, ½ in., LL, LR, and LB
b) Covers, ½ in., blank
Door Openers — mortised
Fish Paper — .0125 in. thick
Fixtures — brass-chain, suspension
Fixture Studs
Fuses
a) Plug-type, renewable, 125-volt, 15 amp.
b) Cartridge-type, renewable, 125-volt, 30 amp.
c) Renewals for plug fuses
d) Renewals for cartridge fuses
Ground Clamps — ⅜ in. to 1 in., assorted
Hickey Grips — ½ in. and ¾ in.
Lamps
a) Carbon, 220-volt, 60-watt
b) Mazda, selected as wattages and voltages
c) Guards for brass sockets
Leather Nail Heads
Lugs — 25- and 50-amp.
Lumber — 2 in. x 4 in. x 14 ft., No. 1, white pine dressed 4 sides
Molding
a) Metal
b) Metal, fittings — crosses, tees, internal elbows, junction boxes, switch bases, keyless receptacles, snap switches
c) Wood, 2-wire, with capping
d) Wood, 3-wire, with capping
Nails — roofing
Nuts — iron, 4–36, 6–32, 8–32, 10–24, 12–24, 10–32, 14–20
Outlet Boxes — 4 in. square, with one round blank cover, and one cover with bushed opening
Pipe Straps — galvanized, ⅜ in., ½ in., ¾ in., and 1 in.
Push Buttons
a) Return-call, 3-point
b) Single
Receptacles
a) Flush, duplex
b) Porcelain-cleat, 660-watt, 250-volt
c) Concealed
d) Covers
Rectifiers — Tungar, for charging from 1 to 12, 6- and 12-volt batteries
Relays — Dixie
Resistance Boards — for testing
Resistance Units — 125-ohm
Rheostats
a) Compression, 275-watt
b) Field, for shunt and compound motors
Rosettes — wood
Rotary Converter — 5-kw. capacity, 3-phase a.c., 110-volt d.c.
Screws
a) Anchors, 8/32, 10/24, 12/24, 14/20
b) Machine, round-head, 4–36 x ¼ in., 6–32 x ½ in., 6–32 x ¾ in., 8–32 x ⅜ in., 8–32 x ½ in., 8–32 x 1 in., 10–32 x ⅜ in., 10–24 x ⅜ in., 10–24 x ¾ in., 10–32 x ¾ in., 12–24 x 1 in.
c) Machine, brass, round-head, 4–36 x ¼ in., 6–32 x ½ in., 6–32 x ¾ in., 8–32 x ½ in.
d) Wood, flat-head bright, No. 5 x ¾ in., No. 8 x ½ in., No. 8 x ¾ in., No. 8 x 1 in., No. 7 x 1½, No. 8 x 1½ in., No. 7 x 2
e) Wood, round-head blued, No. 7 x 1 in., No. 8 x 1½ in., No. 10 x 1½ in., No. 7 x 2
Sleeving — No. 1, white; No. 1, blue; and No. 1, red
Sockets
a) Brushed brass-pull-chain, keyless, key
b) Porcelain, keyless, with caps
c) Porcelain, key, with caps
Socket Caps — ¼ in. and ⅜ in. bushed
Solder Wire — 50/50, size No. 10
Soldering Paste — 2-oz. cans, noncorrosive
Soldering Salts — 1 oz. cans, noncorrosive
Speed Counters — 0–9999
Split Knobs — porcelain
Spring Balances — 0–30 lb.
Starting Boxes
a) For compound motors, various makes
b) For shunt-wound, 1 h.p., 110-volt motors. Overload release
c) For shunt-wound, 1 h.p., 110-volt motors. No voltage release
d) Starting devices of various makes and principles, for 1 h.p., 3-phase, 220-volt a.c. motors
Storage Batteries — 6-volt

(Continued on page 58A)

General Electric Company

General Office: Schenectady, N. Y.

Sales Offices: Address Nearest Office

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New Haven, Conn., 129 Church St.
New Orleans, La., 837 Gravier St.
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Omaha, Neb., 409 S. 17th St.
Philadelphia, Pa., 1405 Locust St.
Phoenix, Ariz., 435 W. Madison St.
Pine Bluff, Ark., 501 Main St.
Pittsburgh, Pa., 436 7th Ave.
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Portland, Ore., 920 Southwest Sixth Ave.
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INTERNATIONAL GENERAL ELECTRIC CO., INC.

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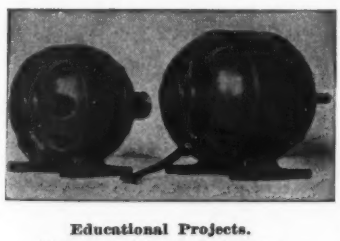
G-E Educational Service

General Electric engineers will be glad to recommend apparatus to meet your special conditions if you will give them details such as: Type of course, number of students, laboratory or shop space available, money at hand for equipment, etc. Further than this, liberal discounts from the regular commercial prices of Company products are allowed to educational institutions. For quotations on apparatus and further information concerning G-E educational service, consult the Educational Specialist at the nearest office of the Company.

The General Electric Company is deeply interested in education, as it recognizes that the future welfare of industry, and of the country as a whole, depends upon how well the students of today are trained for the work of tomorrow. It is the policy of the Company to aid the faculty and students of our schools and colleges in every way possible. To this end, Company publications, motion-picture films, illustrated lectures, etc., are made generally available without charge.

Shop Projects

The General Electric Company, in carrying out its educational program, has sponsored the preparation and publication of several construction projects for technical and vocational schools. These projects are exceptionally valuable for the school shop due to the fact that they are not merely assembly projects but involve a certain amount of mechanical dexterity with such tools as the lathe, drill press, tap and die, etc. The projects available are covered by the following bulletins:



Educational Projects.
¼ H.P. and ¾ H.P. Motors.

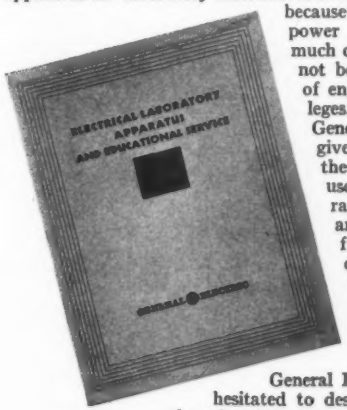
1) ¼ H.P. Single-Phase, 60 cycle, 110 volt motor — Bulletin GES-909
2) ½ H.P. Single-Phase, 60 cycle, 110/220 volt motor — Bulletin GEA-2140A
3) ¾ H.P. 3-Phase, 60 cycle, 110 volt motor — Bulletin GEA-2138
4) 250 watt compound-wound D-C generator — GEA-2289
5) 1½ kw. 220-110/55 volt, single-phase, air-cooled transformer — Bulletin GET-569

Kits for these projects can be purchased from the General Electric Company. In addition, complete instructions are given for the securing of any equipment that may not be included in the kit.

Illustrated Lecture Service

General Electric Motion Pictures are available without charge to educational institutions. They are particularly valuable to schools and colleges, as they enable the student and teacher to keep informed on all important developments in the electrical field. Complete information is available in publication GES-402E.

In general the General Electric Company recommends standard apparatus for laboratory instruction. It is recognized, however, that because of its size, cost, and the power required for operation, much commercial apparatus cannot be used in the laboratories of engineering schools and colleges. For this reason, the General Electric Company has given especial attention to the selection for educational use of such standard apparatus as is of suitable size and which will illustrate fundamental principles of design and construction as well as acceptable commercial practice.



Where standard apparatus is not suitable, the General Electric Company has not hesitated to design special apparatus for the electrical laboratory and shop. Among such special equipment may be mentioned the switchboards both for engineering and physics laboratories, special industrial control panels for A-C. and D-C. service, the AHI synchronous motor (or generator), and the 5 kw. rotary converter.
Thus the student is given an opportunity, while becoming familiar with the underlying principles of electrical engineering, to become acquainted with actual construction details. Bulletin GEA-1185C which has been recently revised, illustrates and describes G-E apparatus particularly adapted for laboratory use.

Electrical Laboratory and Shop Equipment

When deciding on the equipment for an electrical shop or laboratory, Bulletin GEB-62B will be particularly useful. In this booklet will be found listed in three different groups, equipment to meet a wide range of requirements. For the elementary courses a few of the more important types of machines are recommended, together with control apparatus, measuring instruments, and certain machine tools which should be in every electrical shop. For more advanced work, or as funds become available, equipment from other groups may be added to provide well balanced laboratory equipment which will permit a wide range of experiments.
In addition to listing the equipment, this booklet discusses briefly the several items, explaining why they have been selected and the use to which they may be put in the laboratory.

(Continued from page 56A)

Switch
- *a*) Battery, 4-point
- *b*) Bases, porcelain, for 10-amp. switches
- *c*) Boxes, 2¾ in. deep
- *d*) Entrance, safety, 2-pole, 30-amp., with 2-branch lighting circuits
- *e*) Entrance, safety, 3-pole, 30-amp., 250-volt
- *f*) Flush, push-button, S.P., D.P., 3-way, 4-way
- *g*) Surface, S1, S3, and S4
- *h*) Knife, type A, D.P.S.T., D.P.D.T., S.P.S.T., and S.P.D.T.
- *j*) Surface, snap, electrolier
- *k*) Surface, snap, S.P.D.P., 3-way, 4-way

Switchboard — as required

Tacks — double-pointed No. 10

Tape
- *a*) Friction, ½-lb. rolls
- *b*) Rubber, ½-lb. rolls

Telegraph Sets — including sounders, keys, and relays

Telephones
- *a*) Complete bridging, independent phones
- *b*) Couch vestibule telephones
- *c*) Receivers, transmitters, induction coils, condensers, and bridging switch hooks

Transformers
- *a*) Bell-ringing, 6-, 8-, 14-volt
- *b*) Single-phase, 110–220-volt, S.K.V.A.

Tubes — porcelain, 5/16 in. x 3 in., 5/16 in. x 5 in., and 5/16 in. x 10 in.

Tubing — flexible nonmetallic, ¼ in. and ⅜ in.

Washers
- *a*) Iron, ¼ in. and ⅜ in.
- *b*) Brass, ¼ in. and ⅜ in.

Wire
- *a*) Annunciator No. 18 or No. 20
- *b*) Fixture, No. 18, single yellow, with marker
- *c*) Rubber covered, solid copper, No. 10, black
- *d*) No. 10, white
- *e*) No. 14, black
- *f*) No. 14, white
- *g*) Rubber covered, No. 16, brewery cord
- *h*) No. 18, lamp cord, green and yellow
- *j*) S.C.C. copper magnet, enameled, sizes Nos. 16 to 26 inclusive

Electrical Shop—Motor and Testing Equipment

Annunciators
- *a*) Automatic needle-drop
- *b*) Gravity-drop
- *c*) Manual needle-drop

Armatures — burnt-out, for repairing

Battery Charger — commercial

Circuit Breakers
- *a*) Air, single-pole, overload, 25-amp., 550-volt
- *b*) Air, single-pole, underload, 15-amp., 550-volt

Controllers
- *a*) For multiple-speed motor
- *b*) For 1-h.p., 110-volt series motors

Generators
- *a*) Motor-generator set, 10-h.p., to supply 110-volt d.c. for testing purposes, battery charging, etc.
- *b*) Generator, 6-volt d.c., coupled to an a.c. motor for 6-volt circuit testing
- *c*) Auto generators of different makes

Gravity Cells

Magnets — testing, 10,000-ohm

Meters
- *a*) Ammeter, standard, 60-amp., a.c.
- *b*) Ammeter, standard, 60 amp., d.c.
- *c*) Ammeter, student, 60-amp., a.c.
- *d*) Ammeter, student, 60-amp., d.c.
- *e*) Voltmeter, standard, 0–10-volt, d.c.
- *f*) Voltmeter, standard, 110–220-volt, d.c.-a.c.
- *g*) Voltmeter, standard, 125-volt, a.c.
- *h*) Voltmeter, standard, 125-volt, d.c.
- *j*) Voltmeter, student, 110-volt, d.c.
- *k*) Voltmeter, student, 110-volt, a.c.
- *l*) Wattmeter, standard, 110–220-volt, 30–60-amp., d.c.-a.c.
- *m*) Wattmeter, student, 110–220-volt, 30-amp., a.c.-d.c.
- *n*) Watt-hour meter, 125-volt, 5 amp., a.c., single-phase, various makes

Motors
- *a*) Auto starter, different makes
- *b*) Burnt-out, fractional h.p., 110-volt, 60 cycle, for repairing
- *c*) Compound, 1-h.p., 110-volt, d.c.
- *d*) Multiple-speed, 1-h.p., 3-phase, 220-volt
- *e*) Series, 1-h.p., 110-volt, d.c.
- *f*) Shunt, 1-h.p., 110-volt, d.c.
- *g*) Split-phase and repulsive, a.c., 110-volt single-phase, assorted
- *h*) Split-phase induction motors, fractional h.p., 110-volt, 60-cycle, different makes
- *j*) 3-phase, 1 h.p., a.c., 220-volt, various makes
- *k*) 3-phase, 2 h.p., 220-volt, a.c., various makes
- *l*) Universal, fractional h.p., 110-volt, different makes
- *m*) Universal, variable-speed, ½ h.p.

Platform Scale — 100-lb. capacity

Metalwork With Tin Cans

Milton L. Schlechter

South Junior High School,
Grand Forks, North Dakota

55 New Tin Can Projects by J. J. Lukowitz has suggested the possibility of offering to the junior high school another medium of creative expression, the possibilities of which seem unlimited. While the projects may be simple, there is no reason to believe that a course built around an object as lowly as the tin can, will not interest and challenge the imagination of both the beginning and advanced pupil.

It follows, too, that the boy, who acquires the information and technique of tin-can metalwork, can easily branch out and use copper, pewter, and silver as a medium in which to work.

Mr. Lukowitz's book is complete in itself, but every industrial-arts instructor should have an outline of the material he is presenting. That is a matter of good organization. The outline, as worked out by the writer, follows:

An outline of instruction that may be used with a well-known book on tin-can projects.

Content and Procedure

Information

1. A brief discussion to organize information on the sources, uses, extent of use and workability of some of the common metals, principally iron and tin.

2. Discuss the composition of a tin can.

Soldering

1. Define soldering.

2. A brief discussion on soldering irons (coppers):

a) Electrically heated coppers.

b) Externally heated coppers.

c) Advantages and disadvantages of each type:

(1) Relative cost.

(2) Solid and replaceable bits for soldering coppers.

3. A brief discussion on solder, its composition, the common mixtures, and forms obtainable:

a) Discuss alloys with some of their peculiarities.

b) Discuss the use of solder in its various forms with the advantages of each type.

4. Define a flux and discuss the need of fluxes:

a) Discuss oxides — advantages and disadvantages.

b) Discuss the demands of radio manufacturers as regarding fluxes.

c) Mention varieties of fluxes, their uses and limitations with regard to different metals.

d) Demonstrate preparation of killed-acid flux.

5. Demonstrate the soldering of tin and some of the other metals adapted to soldering:

a) Demonstrate cleaning, filing, and tinning.

b) Demonstrate the use of fluxes and the actual soldering operation.

Required Tools

1. Display, explain, and demonstrate use of the common tools needed by the sheet-metal worker, such as the tinsnips, hack saw, ball-peen hammer, files, dividers, and pliers.

(Continued on page 60A)

STANDARD

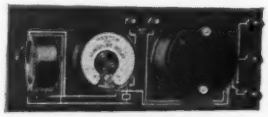
for INSTRUCTION, RESEARCH, INDUSTRY

The use of WESTON instruments in educational work and scientific laboratories has become a fixed principle, for nothing short of WESTON accuracy and dependability are acceptable for engineering training. WESTON instruments are made to most exacting standards of craftsmanship and accuracy. They inspire students to be exact in experiments. And in using WESTONS in training, the student is familiarizing himself with the instruments he will use throughout his engineering career, for student graduates since 1888 have "Westonized" the industrial world.

Following is a condensed listing of the WESTON instruments available; also are illustrated a few of the models widely used in educational work. Complete information on all models is available in booklet form, and will gladly be sent on request. Weston Electrical Instrument Corporation, 595 Frelinghuysen Avenue, Newark, New Jersey.

MODEL 622
Ultra-Sensitive Microammeters, Millivoltmeters

Double pivoted type instruments for measurement of minute currents. Ideal for laboratory work and circuits involving thermocouples, pyrometers, electron tubes, etc.



MODEL 607
***Photronic Photoelectric Relay**

Ideal to demonstrate theory and operation of photoelectric cells and sensitive relays. Consists of a WESTON Photronic Cell, a WESTON Sensitive Relay and a Power Relay mounted on a common base and wired. No outside voltage, nor troublesome amplifier required.

MODEL 280
Miniature Precision D.C. Instruments

Convenient and practical for student use, combining miniature size and ruggedness. Size 4⅜ x 4⅜ x 1½ inches. Accuracy 1% . . . hand calibrated mirror scales and knife-edged pointers. Available in single and multi-range instruments.

PORTABLE INDICATING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

PANEL MOUNTING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

INSTRUMENT TRANSFORMERS
Portable and Switchboard – Potential and Current

RELAYS
Sensitive and Power Uses – Current and Voltage Types

AIRCRAFT INSTRUMENTS
Tachometers, Temperature Indicators, Radio Compass Indicators, Ammeters, Voltmeters, etc.

ELECTRIC TACHOMETERS
A.C. and D.C. Types – Remote Indicating

LABORATORY STANDARDS
Voltmeters, Ammeters, Wattmeters

SPECIALIZED TESTING EQUIPMENT
Power Analyzer, Photoelectric Potentiometer, Battery Testing Instruments

SERVICE EQUIPMENT
Tubecheckers, Analyzers, Oscillators, Ohmmeters, Vacuum Tube Voltmeters

PHOTOELECTRIC CELLS
"Photronic" Cells – Dry Disc Type

PHOTOELECTRIC CONTROL DEVICES
"*Photronic" Cell Controls, Illumination Controls, Smoke Alarms, Industrial Controls

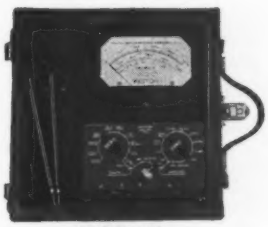
LIGHT MEASURING DEVICES
Illumination Meter, Foot Candle Meters, Sight Meter, Exposure Meters

TEMPERATURE INDICATING INSTRUMENTS
ELECTRICAL TYPE – Remote Indicating
BIMETALLIC DIAL TYPE – Laboratory, Industrial

INSTRUMENT ACCESSORIES AND PARTS
Shunts, Cables, Resistors, Switches, Binding Posts, Leads, Multipliers, Adapters, Radio Plugs, etc.

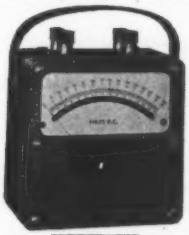
STANDARD CELLS

*** Photronic – A registered trademark designating the photoelectric cells and photoelectric devices manufactured exclusively by the Weston Electrical Instrument Corporation.**



MODEL 765
Volt-Milliammeter

Preferred by schools because of its high sensitivity and broad ranges. 10 D.C. voltage ranges, sensitivity 20,000 ohms-per-volt – 10 A.C. volt ranges. 12 D.C. current ranges – 10 D.B. ranges.



MODEL 430
Portable, Precision A.C. and D.C. Instruments

Universally used in schools and industry wherever rugged, portable instruments are required for general testing. Hand calibrated, mirror scales with knife-edged pointers.

MODEL 375
Student Galvanometer

Widely used in school laboratories where durability and low cost are requirements, rather than extreme sensitivity. Other models of medium and high sensitivity available.

WESTON *Instruments*

(Continued from page 58A)

Required Supplies

1. Procure and have on hand necessary supplies for soldering, cleaning, and finishing projects.

Some Desirable Equipment

1. With the progress of the class make or procure simple barfolders, jigs, etc., for advanced work.

Projects

1. Have on hand patterns and finished models of desirable projects.
2. Have on hand suitable textbooks and magazines for reference in selecting desirable projects.

Finishing Projects

1. Explain reasons for finishing projects.
2. Discuss finishing materials.
3. Discuss care of finishing materials, equipment, and solvents for cleaning brushes, etc.

Bibliography

Bollinger, J. W., *A Course in Sheet Metal Work*, Bruce Publishing Co., Milwaukee.

Jones, H. A., *Metal Work for Grades VII, VIII, IX*, Bruce Publishing Co., Milwaukee.

Lukowitz, J. J., *55 New Tin Can Projects*, Bruce Publishing Co., Milwaukee.

Welch, R. L., *Elements of Sheet Metal Work*, Bruce Publishing Co., Milwaukee.

Expert Soldering, Stanley Tool Co., New Britain, Conn.

File Filosophy, Nicholson File Co., Providence, R. I.

Soldering Facts, Kester Solder Co., Chicago, Ill.

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION Magazine, Current issues, Bruce Publishing Co., Milwaukee.

New Publications

Plastics — Problems and Processes

By Dale E. Mansperger and Carson W. Pepper. Cloth, 187 pages, 6⅛ by 9¼, illustrated. Published by The International Textbook Co., Scranton, Pa.

This book on the comparatively new, fascinating materials known as plastics, has been designed specially for the student in the school shop, for the home craftsman and for the man who wants to be informed about the new materials adopted and used in industry today.

The book goes into a popular description of this interesting and beautiful material which has emerged from the chemist's test tube within the past few years. Then, there is a chapter on the tools needed and the forming and shaping operations that can be applied. Then follows a considerable number of well-illustrated and detailed projects which will delight the worker who loves to make dainty and colorful pieces of work for use in home, school, store, and office.

Metallurgy

By Carl G. Johnson, R. S. Dean, and J. L. Gregg. Cloth, 149 pages, 5¾ by 8¼, illustrated. Price, $1.50. Published by The American Technical Society, Chicago, Ill.

An introductory text to the science of metallurgy which presents some of the knowledge that is available on the manufacturing and behavior of the metals and alloys now used by industry.

Among the items discussed are: Properties and uses of metal; testing, chemical metallurgy of alloys; nonferrous metals, and iron and steel; the manufacturing of iron and steel; physical metallurgy; iron-carbon diagram; shaping and forming metals; SAE steel specifications; carbon steels, and powder metallurgy.

Motion Pictures in Education

By Edgar Dale, Fannie W. Dunn, Charles F. Hoban, Jr., and Etta Schneider. Cloth, 472 pages, 6¼ by 9¾, illustrated. Price, $2.50. Published by the H. W. Wilson Company, New York City.

This summary of the literature on motion pictures in education was prepared under the auspices of the Committee on Motion Pictures in Education of the American Council on Education. It consists of short digests of a large number of books on the subject.

The book is divided into six parts. The first of these is on the administration of visual aids in a city, a school, a state, and on a national basis.

News Notes

♦ More than 7,000 young men in various parts of the country are receiving training in aviation, under the auspices of the Federal Government which is providing financial assistance to vocational education.

Figures issued by John W. Studebaker, U. S. Commissioner of Education, show that in federally aided vocational schools and classes in the United States, there are 2,188 students in daytime classes, 3,242 in part-time classes, and 1,653 in evening trade-extension classes.

At the commercial air base in Miami, Fla., ten classes are being conducted by the board of education, with federal aid, to train employed aviation mechanics. In New York City, 500 young men are being prepared for this field. In Chicago, where airlines maintain repair stations, a large number of men are in training.

♦ The world's largest conveyor belt, now in operation at Grand Coulee Dam in Washington, required 120 bales of cotton in manufacture. Built by the Goodyear Tire and Rubber Company, Akron, Ohio, the belt is 9,700 ft. long, and is conveying 2,000 tons of coarse stone (up to 6-in. diam.) per hour, for one of the biggest construction jobs ever attempted by man.

♦ New equipment, including twelve engine lathes, a milling machine, a shaper, a power hack saw, a surface grinder, and a forge and blower have been installed in the machine shop in the Hamtramck, Mich., Vocational School.

In the general shop, two wood and metal spinning lathes, a jointer, and a universal saw have been added. The print-shop equipment has been supplemented with a paper table and bins, two hand presses, and a trimmer saw.

♦ *How to Use Radio* by Kenneth L. Bartlett, is a paper-covered booklet of 42 pages, published by the National Association of Broadcasters, Washington, D. C. It offers an outline of practical suggestions for the teacher and the radio chairman. It discusses what radio can do for education, what educational groups can contribute to the subject, and the problem of adapting educational material to the air.

This booklet will be supplied to teachers gratis upon request to the Association.

♦ Superior, Wis., recently dedicated the newly constructed Superior Vocational School which was built at a cost of $250,000 with federal and local funds.

♦ Dr. Edward R. Weidlein, Director, Mellon Institute, Pittsburgh, Pa., has announced the establishment of an Industrial Fellowship in that institution by the American Air Filter Company, Inc., of Louisville, Ky. This Fellowship will investigate broadly materials of value in the construction of filters for air-conditioning systems. In this work the Fellowship will have the direct co-operation of specialists on the staff of the Multiple Industrial Fellowship on air hygiene in operation in the Institute.

Dr. Frank F. Rupert has been appointed to the incumbency of the Fellowship.

Personal News

• WARREN E. BOW, assistant superintendent of Detroit Public Schools, was elected president of the Detroit Area Council, Boy Scouts of America, January 21, at the annual meeting and dinner of the organization.

• MR. CLIFF FICKE, Ludlow, Ky., will teach vocational printing in the morning classes at the Dixie Heights School (near Erlanger), and in the afternoon classes at Simon Kenton High School, Independence, Ky. Approximately 25 students from each school have enrolled. Equipment to be purchased immediately will total about $500.

• MR. HARRY A. JONES has been appointed Technical Inspector for the Province of British Columbia, Canada.

Harry A. Jones

• The death of VICTOR L. VALASKE on January 12, for ten years the vocational-department head, and later boys' counselor at the Jackson Intermediate School, Detroit, Mich., is mourned by his many friends and coworkers. Born at Menomonie, Wis., in 1900, he was graduated from the Stout Institute of that city in 1920 with a diploma, later obtaining a degree of Bachelor of Science in education from the Detroit Teachers' College in 1926. He attained the degree of Master of Arts from the University of Detroit in 1932. Mr. Valaske was appointed a member of the staff of Detroit Public Schools Department of Vocational Education in 1922, teaching at the Hutchins Intermediate School until his promotion to the Jackson Intermediate School in January, 1929.

• DR. VERNE C. FRYKLUND, Assistant Professor of Industrial Education, Wayne University, Detroit, Mich., will be a guest professor at the University of North Carolina for three weeks at the beginning of the summer session. He will return, however, in time for the summer session at Wayne.

Association News

♦ The third meeting of the newly organized Central New York Industrial Teachers Club was held on Thursday, January 12, at Oswego High School, Oswego, N. Y. Reports on new projects, books, and materials were given by Gene Essex and G. O. Wilbur of the Oswego State Normal School, and Courtney Newstead of Mexico Central School. Thomas L. Handley of the Oswego High School led a round-table discussion on lesson preparation.

At previous meetings which were held at Fayetteville and Solvay, the following officers were elected: President, John McAnaney, Solvay; vice-president, Thomas Crabtree, Oswego; secretary, Albert Saunders, Fayetteville; corresponding secretary, Courtney Newstead, Mexico; treasurer, Edward Mason, North Syracuse.

The February meeting was held at Phoenix High School, Phoenix, N. Y., on February 9.

♦ A National Conference on Industrial Arts Teacher Education will be held at the Hotel Cleveland, Cleveland, Ohio, during meetings of The American Association of School Administrators.

(Continued on page 62A)

As the EMPLOYER sees it . . .

(Page 240, Industrial Arts, June 1938)

"The more the school follows *industrial methods of production*, the more efficient will be its training output. If we are to use the school trainees, we want them trained in our *methods of production*."

So states industry . . . and the *industrial method of producing prints*, the method that is rapidly replacing all other photo-reproduction processes, *is the Ozalid White Print Process!*

This definite departure from obsolete methods . . . this sweeping swing to Ozalid is the logical result of the many advantageous features offered only by this modern method of making prints . . . features that are saving industry thousands of dollars each and every year!

As the INSTRUCTOR sees it . . .

(Letter from a vocational school, 1938)

"We have found the Ozalid Process ideal for school use, particularly as an instructional device. All of our students are taught to operate the machine . . . an arrangement scarcely possible without the simplicity, speed, and particularly the cleanliness of the process."

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NEW Ozalid MACHINES

NEW OFFICE-SIZE OZALID MACHINE

The new Model D Printer-Developer provides easier and faster duplication of examinations, programs, assignment sheets, printed forms, etc. Accommodates material up to 9 inches wide. Requires no stencils, carbons or type.

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- ☐ The Ozalid Model D Machine for duplicates up to 9" in width.
- ☐ The Ozalid Model E Machine for duplicates up to 42" in width.

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SCHOOL_____

STREET_____

CITY_____ STATE_____

1A & VE 3-39

Drafting Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Adjustable-Curve Ruler
Beam Compass
Bench Brushes
Blackboard
- *a)* Permanent or portable
- *b)* Compass, 15 in., with locking device
- *c)* Drawing set: T square, straightedge, triangle, and protractor

Blueprint
- *a)* Frame or machine
- *b)* Washing trays or washer
- *c)* Paper tube, air-tight
- *d)* Drying rack or dryer

Bookcase
Cabinet
- *a)* For filing drawings
- *b)* For storing drawing boards
- *c)* For storing drawing instruments
- *d)* For storing models

Calipers — 6 in. and 8 in., inside and outside
Chair — teacher's
Desk — teacher's
Dividers — proportional
Drafting machine — and accessories
Draftsman's Steel Protractor
Drawing Boards — large
Drawing-Board Supports — to be set on or attached to woodworker's bench
Drawing Tables and Stools
- *a)* For Students
- *b)* For Teachers

Ink-Bottle Holder
Irregular Curves — Nos. 17, 21 and 24, wood, rubber, or transparent
Lettering Angles
Lettering Pens — assortment of 12
Level or Transit — builders' for architectural students
Leveling Rod — for use with the transit
Machinists' Combination Set — 12 in.
Marking Pins — for use with measuring tape, for architectural students
Micrometer — 1 in., for mechanical-drafting students
Oilstone — 3 in. case
Pantograph — 21 in.
Parallel Rules
Planimeters
Plumb Bob
Shears — for trimming blueprints and drawings
Speed Counter — for mechanical-drafting students
Steel Scales — 12 in.
Stop Watch — for mechanical-drafting students
Table
- *a)* For cutting and trimming drawings and blueprints
- *b)* For disassembling and reassembling machine parts and models

Tapeline
- *a)* 100 ft. steel, for architectural students
- *b)* 50 ft., steel or metallic

Tool Box — containing 1 machinists' hammer, one 6 in. adjustable wrench, one 6 in. screw driver, one 6 in. combination pliers
Triangles
- *a)* 30–60-deg. 14 in. transparent
- *b)* 45-deg. 10 in. transparent

Triangular Scales — civil engineers' type, 12 in.
T Square — adjustable or fixed head, for large drawing board or straightedge with parallel rule attachment for large drawing boards
Wall Charts — lettering, decimal equivalents, etc.
Yardstick

Drafting—Small Equipment

To be provided by, or for, each student
Drawing Board — size to be specified by instructor
Drawing Instruments — as specified by instructor
Erasing Shield
Irregular Curve — Nos. 8 and 13, transparent
Pencil Compass
Penholder — for lettering pens
Pens — assorted, for lettering
Protractor — not over 5 in.
Scale — 12 in. architects', triangular
Scale Guard
Slide Rule — 10 in., as specified by instructor
T Square — to fit drawing board
Triangles — 30–60-deg., 10 in. transparent, and 45-deg., 8 in. transparent

Drafting Supplies

Bichromate of Potash — crystals
Blueprint
- *a)* Paper, 36 in. wide
- *b)* Writing fluid

Paper
- *a)* Cross-section, 8½ in. x 11 in.
- *b)* Detail, 24 in. x 36 in.
- *c)* Drawing, 24 in. x 36 in.
- *d)* Isometric, 7 in. x 10 in.
- *e)* Tracing, 36 in.

Powder — for tracing cloth
Tracing cloth — 36 in.
Van Dyke
- *a)* Fixing salts
- *b)* Paper, 36 in.
- *c)* Writing fluid

Drafting—Additional Supplies

To be provided by, or for, each student
Erasers
- *a)* Cleaning
- *b)* Ink
- *c)* Pencil

Ink
- *a)* Black, waterproof
- *b)* Colored, if required

Pencils — drawing, HB, 2H, 3H, 4H, and 6H
Pencil Pointer Pad
Thumbtacks

(Continued from page 60A)

The present conference program has been initiated and planned by the leadership of Epsilon Pi Tau, the national honorary professional fraternity in this field, in celebration of its tenth anniversary.

On Monday, February 27, at 9:30 a.m., Dr. William E. Warner, the general chairman, will state "The Nature and Purposes of the Conference." This will be followed by a luncheon at which "The Prospective Teacher" will be discussed, with Dr. Lawrence F. Ashley presiding. At 2:30 p.m., the topic for discussion will be "The Curriculum Spread and Viewpoint," with Professor John R. Ludington acting as chairman.

On Tuesday, at 9:30 a.m., the topic for discussion will be "Administrative Policies and Practices." Professor William D. Stoner will preside. At the luncheon which will follow, "Laboratory Plans and Equipment" will be discussed. At 2:30 p.m., "Ways of Developing the American Program" will be the topic, and Dean C. E. Partch will preside.

♦ The Eastern Pennsylvania Industrial Arts Conference will hold a meeting at the State Teachers College, Millersville, Pa., on April 15, 1939.

♦ The winter meeting of the Fairfield County Industrial Arts Association was held at the new Norwalk Senior High School, Norwalk, Conn., January 11, 1939. Dr. Paul N. Wenger, president of the Association, presided.

Following the business meeting, Mr. Garton Wager, Director of Industrial Arts in New Rochelle, N. Y., presented an informal address entitled "Reconsidering Industrial Arts."

♦ The Department of Industrial and Vocational Education of Kansas State Teachers College, Pittsburg, Kans., held its Fourth Annual Dinner in the Arabian Room, Hotel Besse, Pittsburg, on Saturday evening, January 14, 1939, at 6 o'clock. The purpose of the annual dinner is to receive reports from members of the staff who attend the meetings of the Manual Arts Conference of the Mississippi Valley and of the American Vocational Association.

This year, two men attended the Manual Arts Conference in Chicago, November 10–12, 1938, and eleven men attended the convention of the American Vocational Association in St. Louis, November 30 to December 3. Each speaker was given the opportunity to select one session of the convention on which to prepare a report.

♦ The Annual Get-Together Banquet of the Massachusetts Industrial Education Society was held Saturday, January 14, 1939, at the Hotel Lenox. About 125 members attended. The guest speaker was Mr. J. Burke Sullivan, Assistant Attorney General, Commonwealth of Massachusetts. His subject was "The Law Affecting School Appropriations as Presented Before the Middlesex Grand Jury." Mr. Sullivan was the attorney for the Commonwealth of Massachusetts who presented the case against the city of Woburn.

The prizes which were donated by the members were for the most part projects made by students in the junior and senior high schools of various cities in Massachusetts. — *G. A. Larson.*

♦ The second annual convention of the Texas Vocational Association will be held at the Rice Hotel, Houston, Tex., March 23–25, 1939.

♦ A meeting of the School Crafts Club was held on Saturday, January 21, 1939, at the West Side Y. M. C. A. Building, New York City. After a rather lengthy business meeting, two very interesting and educational pictures on aluminum were shown.

The next meeting will be held on Saturday, February 19, 1939. Professor Wayne Hughes of the Safety Center, New York University, will

(Continued on page 64A)

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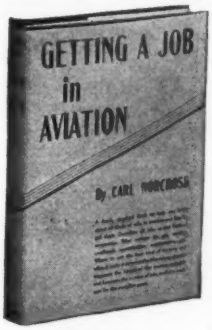

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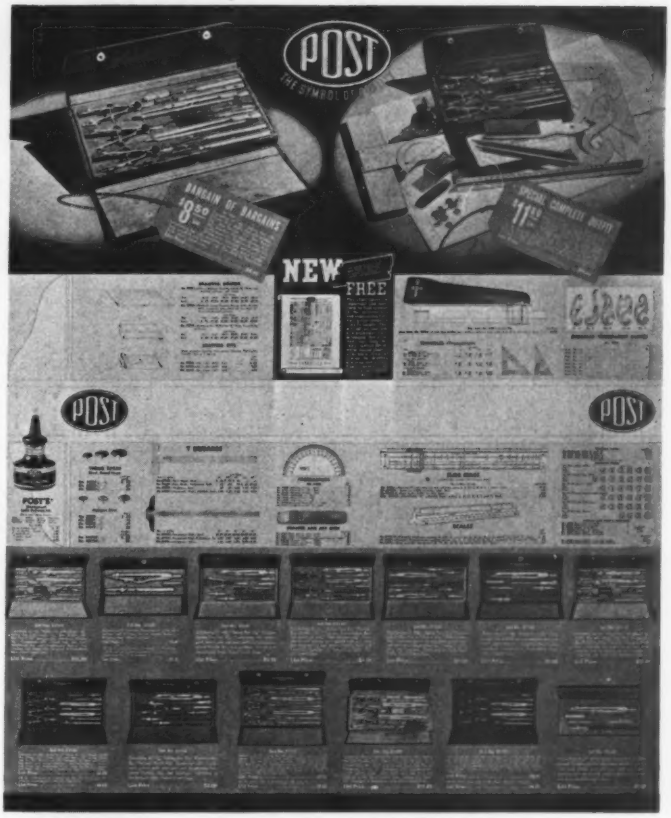

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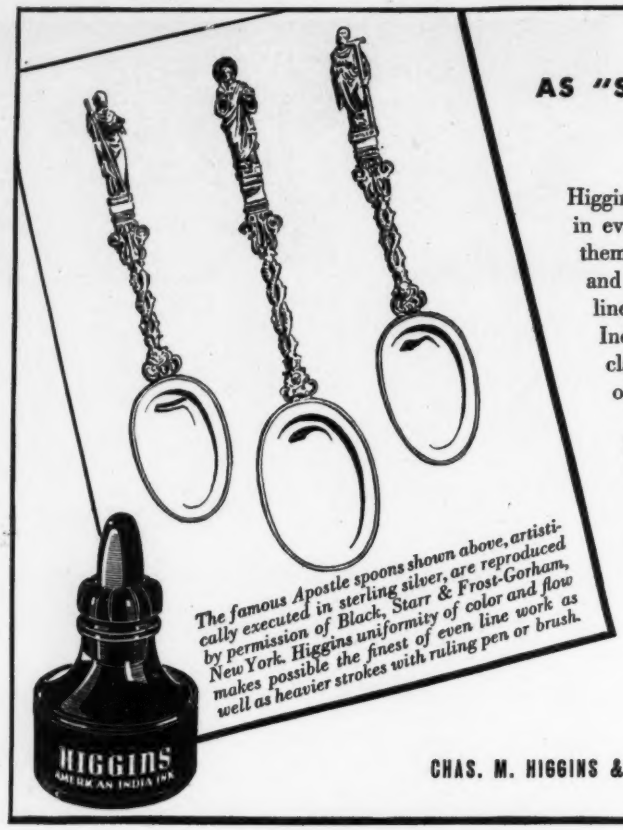
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(Continued from page 62A)

lecture on "Safety in Industrial Arts Education." He will be followed by Mr. Aumack and Mr. Karl Ufer of William Dixon, Inc., Newark, N. J., who will give a lecture and demonstration on "Art Metal and Jewelry."

♦ The New England Drawing Teachers Association will hold its convention in New Haven, Conn., on April 9, 1939. Carl L. Swan, Newton High School, Newtonville, Mass., is the secretary.

♦ The New York State Vocational Association will hold its convention in New York City, April 11 to 13, 1939. Roy F. Johncox, 2 Saratoga Ave., Rochester, N. Y., is the secretary of the association.

♦ The Iowa State Drawing Conference, will hold its convention in Ames, Iowa, April 14 and 15, 1939. The president of the association is Professor O. A. Olson, Room 404, Engineering Bldg., Ames, Iowa.

♦ The Eastern Arts Association will hold its convention at the Hotel Pennsylvania, New York City, April 19 to 22, 1939. The secretary is Raymond P. Ensign, 250 East 43rd Street, New York City.

♦ The Western Pennsylvania Arts Conference will hold its convention in California, Pa., April 22, 1939. The chairman will be S. L. Coover, Teachers College, California, Pa.

♦ The Illinois Vocational Association will hold its convention in Moline, Ill., April 13–15, 1939. The secretary is N. F. Fultz, Morton Schools, Cicero, Ill.

♦ At a meeting of the St. Louis Elementary Industrial Arts Club, the following officers were elected for the coming year: President, Clay VanReen; vice-president, Thaddeus French; secretary-treasurer, J. Earnest Kuehner.

♦ The Western Illinois Industrial-Arts Round Table held its second meeting of the year on December 7, in Galesburg, Ill. Approximately sixty industrial and vocational instructors were present.

Mr. J. S. Ducray, Moline, president of the society, conducted the business meeting. Mr. J. Morgan Johnson, Moline, president of the vocational division of the Illinois Vocational Association, reported that Moline had been selected as the convention city for the next meeting, to be held April 14–16. It was voted to hold the March meeting of the Illinois Round Table in East Moline.

The program of the society was in charge of Mr. Thomas Brooking, of Galesburg. Supt. R. V. Lindsey, of Galesburg, spoke on "Vocational Training in the Junior and Senior High Schools." Dr. Harry McKown, of the University of Missouri, talked on the subject, "Whoever Heard of Such a Thing." The program was concluded by Clem Williams, of Galesburg, who showed pictures from "Mother Earth."

♦ Grand Rapids has been selected as the convention city for the American Vocational Association in 1939. The Michigan Industrial-Education Association will also meet in the city April 26–28, 1939.

♦ On October 14, 1938, the Eta Chapter of Epsilon Pi Tau at Peru State Teachers College, Peru, Nebr., presented memberships to the following: Joe Vacek, Ernest Galloway, Paul Blair, Ben Sheldon, C. H. Carter, and George Mort. The keys were presented by Professor C. R. Lindstrom. Dr. William E. Warner was the speaker.

Answers to Questions

PAINTING WINDOW SHADES

1048. Q.: I have some cream-colored window shades which I would like to color with a black paint (on the inside). What kind of paint should I use, that will not crack or penetrate so as to discolor the cream color on the outside. I want the black so as to use the shop for motion pictures.

What kind of white or cream paint may I use on some of these shades which are to be used for sketches, and drawings, in the mechanical-drawing room as reference charts? — *W. T. T.*

A.: Instead of using black paint on your shades, I am suggesting that you use aluminum bronze coating instead. Experience has determined that this coating has a superior quality both as to absorption and reflection as compared to other paints. This bronze may be either brushed, or preferably sprayed. It should be made from varnish grade aluminum bronze wet slightly with pure turpentine and then mixed with pale varnish in the ratio of 2 lb. of bronze per gallon of varnish, or in the same proportion for smaller amounts. Let dry very hard before rolling up as is usual with shades.

For the cream paint, use a standard eggshell wall paint cut in half with thinner made from one part of pure turpentine and two parts of standard grade gasoline. Apply with spray gun if possible, otherwise use a wide brush to apply the coating freely but thinly. Avoid a heavy coating which will crack when the shades are rolled. To clean these shades from time to time, lay out on a wide table and sponge off with a tri-sodium-phosphate solution made from one-half cup of powder per 12-qt. pail of hot water. Wipe dry. — *Ralph G. Waring.*

(Continued on page 66A)

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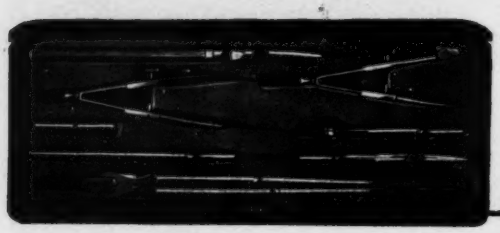

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THE COMPLETE HANDICRAFT SERVICE

(Continued from page 64A)

PAINTING THE FLAGPOLE

1053. Q.: How should a freshly cut, debarked larch tree be treated in the way of a finish so that it will be satisfactory for use as a flagpole? — *D. V. O.*

A.: Prime this peeled pole with a good coat of outside lead and oil paint carrying an extra pint of pure turps per gallon of paint. Let dry hard and then give two coats of full-bodied lead and oil paint after puttying up such checks as have appeared at this time. Be sure the putty is hard before final coating, which should be done if possible from a boatswain's chair after the pole is erected so as to avoid marring the fresh paint. Some checks will appear in after years and can be puttied but will not affect the sturdiness of the pole. — *Ralph G. Waring.*

DEEP RED-BROWN MAHOGANY STAIN

1043. Q.: On page 156 of *Principles of Mill and Paint Shop Practice*, there is a formula for a deep red-brown mahogany stain. Are the sap brown, mahogany brown, and mahogany red specified in this formula water-soluble powders such as put out by the Dakelite Corp.? What is acid black 10B and naphthol yellow? Will this deep brown mahogany, when mixed, stay true in color for an indefinite period? — *W. M. M.*

A.: Sap brown, mahogany brown, and mahogany red are the base materials as sold by the Dakelite Corp., South Minot, N. Dak. Acid black 10B and naphthol yellow can be purchased from the Pylam Products Co., 77 Greenwich St., New York City, and are standard dyestuffs of the so-called acid-dye type. These will stay in solution provided distilled water or soft water free of lime or magnesia salts is available. In the presence of such salts in permanently hard water, the dyestuffs will be thrown out of solution and most of the color value lost. — *Ralph G. Waring.*

RUBBING VARNISH — RED FINISHES ON MAPLE

Q.: What make of rubbing varnish (clear) would you recommend? I am also interested in these so-called new color finishes (cherry or red) used on maple furniture. What are the steps used to produce such a finish? — *L. A. M.*

A.: I avoid the use of rubbing varnish since many years research shows that varnish failures on furniture are due to the practice of using several varnishes on the same piece of work. As a matter of fact, with the newer 4-hour type of varnishes, there is a questionable value as to the use of rubbing varnish at all. Where several grades of varnish are used, one over the other, different rates of expansion occur and because of this lack of compatibility and equality in expansion, checking will generally occur in less than a year. On the other hand, this can all be avoided by the use of a high-grade 4-hour floor varnish such as Pratt and Lambert Co. No. 61. This will prove very durable, as easy to rub as can be expected in so tough and durable a piece of goods, and since the several coats applied are all from the same can of stock, the expansion factors are constant. As a matter of test, two sets of kindergarten furniture finished as above with No. 61 and with a standard rubbing varnish, the former is still in fine condition after nine years of service while the latter in the same room failed in eleven months.

The red finishes mentioned have nothing to recommend them since they will not harmonize with any of the walnut, mahogany, or maple colors. On the latter they are an absolute incongruity to say the least. However, if you wish to match such colors, make up standard 4-oz. solutions of orange, red, and black. By using 4 oz. of stain powder (water-soluble type) per gallon of hot water and mixing these in another container in such proportions as you may determine experimentally for the particular wood you are using, then you will be in a position to match any color shown. One word of caution, keep accurate records of what you do. — *Ralph G. Waring.*

New Products

THE NEW DUAL CUP-WHEEL ground circular saws just introduced by E. C. Atkins and Co., 404 So. Illinois St., Indianapolis, Ind., eliminate the tendency to heat the rim of saws used for cutting either wood or metal. They also obviate the burning of the material that is being cut.

This line of "Clearance Grind Saws," also known as "Cup Wheel Grinds," do decidedly better sawing. The name refers to the clearance established between the teeth and the cut material by a new operation of dual cup-wheel grinding. Beginning exactly at the outer edge of the circular saw or knife, the blade surface is dished out microscopically by special clearance grinding. Only at the rim, which is the extreme edge of the cutting teeth, is the metal of full thickness. There, it is the same gauge as the center. This relief area is

(Continued on page 69A)

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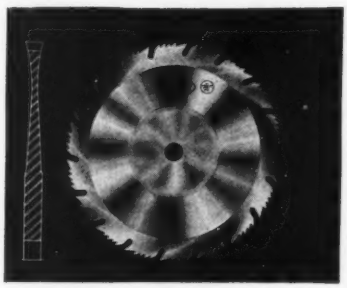
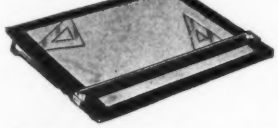
(Continued from page 66A)



not to be confused with grinds such as hollow and planer types which have some flat full-gauge surface the full depth of the teeth.

This clearance offers important advantages to every saw user. It means free running with smoother cuts and less effort by the operator. These features are easily converted into higher production. A circular miter saw, a glue joint ripsaw, a high-speed steel saw, certain heading cutters, veneer knives, and several types of metal saws, all of Atkins special "silver steel" are offered in this line.

THE DRAW-O-MATIC, manufactured by the Rollin Instrument Co., Inc., 216 N. Clinton St.,



Chicago, Ill., is a mechanically operated drawing board that has many very practical features. It is built to a high standard of quality. There are no obstructions on the face of the board, nothing to catch on the clothing, nothing to get out of order. The durable, smooth composition board stays flat, and water, oil, or acid will not harm it.

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No thumb tacks are required with this board as small squares of adhesive drafting tape hold the paper to the board more securely without damaging the board or paper.

THE WISCONSIN LABORATORIES, 2324 W. Wisconsin Ave., Milwaukee, Wis., have just marketed "Portexem," a new mechanical and chemical brush conditioner and container which preserves and protects all kinds of oil paint and varnish brushes, and brings back into use old and discarded brushes.

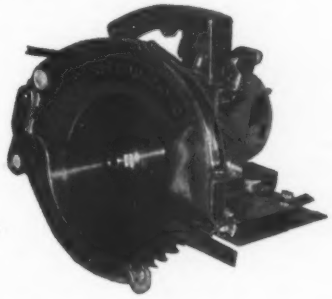
The process is carried out by the employment of a regulated, slowly evaporating liquid that generates a heavy nonpoisonous and noninflammable vapor that drives all the oxygen out of the container, preventing oxidation of the paint, or varnish on the brushes.

The cost of this brush conditioner, and of the vaporizing liquid, is nominal. One pint is sufficient for several months operation under ordinary conditions.

A 10-IN. SAW HAS BEEN ADDED to the line of Speedmatic saws made by the Porter-Cable Machine Co., Syracuse, N. Y. It has a cutting capacity of 3¾ in. With this new larger model, the several exclusive features of the Porter-Cable line of Speedmatic saws are now available to those who have heavier cutting to do.

In this line of saws, helical-cut gears are used. This type of gear is highly efficient and delivers more power to the blade, and operates at higher speeds. The blade speed of the new 10-in. model is 4000 r.p.m. which results in faster, cleaner cutting.

This new saw is very compact and its weight is evenly distributed. The handle can be placed immediately above the cutting point. These advantages make the Porter-Cable Speedmatic



saws one-hand saws that can be comfortably and easily operated for long periods of time.

The blade is placed safely away from the operator, and directly in line with his eye while working in a normal position. Adjustments for depth and angle have also been greatly improved so that the setup may be quickly made and positively locked.

A large base or shoe permits this new model to rest firmly on the work and assures safety and a greater degree of accuracy in cutting.

A rig gauge is provided with the machine. This gauge can be set to the required distance and

(Continued on page 72A)

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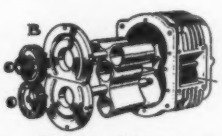

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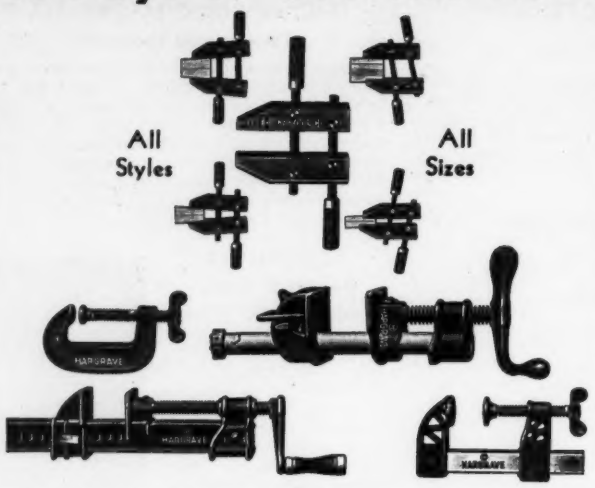

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Send us your requirements for quotation. No obligation.

THE TEGGE LUMBER CO.
1500 W. Bruce Street Milwaukee, Wis.

(Continued from page 69A)

guides the saw from the edge of the stock. It is turned up and out of the way when not used, yet remains on the machine handy for use at any moment.

Like other models in the Speedmatic line of saws, the new K-10 model can be used on the radial arm unit, made by the manufacturers and which provides a universal type cut-off and rip machine.

THE SNAP-ON TOOLS CORPORATION, Kenosha, Wis., have perfected new Ford and Lincoln-Zephyr cylinder-head pullers which offer a safe, sure, and easy method for removing these aluminum heads which often are difficult to remove, but the particular construction of these new pullers takes the danger of damage out of this job. These new pullers operate on very much the same principle as the iceman's tongs. Two clamps are needed, one for each end of the cylinder head. Crosspieces are placed directly across the head, resting on the first straight row of three bolts at each end of the head, with the pressure screws directly above the two outer bolts in these rows.

The clamps are then tightened, the inner one until it grasps the curvature of the head firmly, the outer one until it has forced itself a sufficient distance into the gasket and between block and head so that it provides a good support.

These tools work at the outside edges of the head where the metal is thick and the section strong, and they distribute the load evenly over four points.

THE OZALID MODEL E WHITE PRINT MACHINE, marketed by the Ozalid Corporation, 354 Fourth Ave., New York City, constitutes a complete

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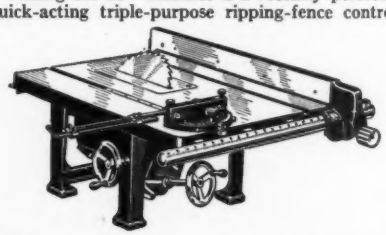
Careful engineering, based on many years of experience, has produced this truly amazing machine, which includes a rotating glass cylinder, providing rolling contact instead of sliding static-producing contact, and insures maximum utilization of the light rays emitted by a single Cooper Hewitt mercury vapor tube. It handles all Ozalid sensitized materials up to and including 42 inches in width at speeds up to 30 linear inches per minute, yet is only 56 inches wide, 18¼ inches deep, and 18 inches high.

All air entering the cylinder for cooling the mercury vapor tube is filtered to minimize dust deposits on the burner contained within the glass cylinder, a feature found in no other photo-printing equipment.

THE BOICE-CRANE COMPANY, Toledo, Ohio, are announcing a new model of their famous No. 2500 tilting arbor saw.

Among the new features is a recently perfected quick-acting triple-purpose ripping-fence control.



A single control handle now fast feeds, microfeeds for close setting, and securely locks the ripping fence. A second control locks the rear end of the ripping fence when necessary.

The ripping fence is carried on accurately calibrated tubular bar on the front. One model rips to 21 in. wide, a second to 37 in. wide.

Table size is 20 by 27 in. Bench and floor-stand models with motors from ½ to 1½ h.p. are available.

THE NEW NO. 2–18 AND NO. 2–24 plain automatic milling machines recently announced by the Cincinnati Milling Machine Company were specially designed for the rapid production of medium-sized work.

These machines are of the fixed-bed type and have a table travel of 18 or 24 in. Powered with a 5-h.p. motor, these milling machines have ample capacity to handle a large variety of work. To obtain maximum efficiency, the machines feature 20 spindle speeds, ranging from 30 to 1200 r.p.m., and 16 feeds from 1 to 40 in. per minute. To further adapt the machines to high production

(Continued on page 73A)

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Forms returned same day received.

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(Continued from page 72A)

milling, an automatic spindle top; a hydraulic backlash eliminator and dog-controlled, automatic working cycles for the table, with intermittent feed are provided.

Spindle speeds are selected by pick-off gears and a back gear lever. Pick-off gears fit snugly over steep angle, ground tapers and are driven by double keys. The gears are readily accessible and are secured by large nuts to exact alignment on the tapers. Gears not in use are stored in a convenient protecting compartment in the rear side of the headstock.

Only four gear contacts are made in the completely antifriction spindle drive unit, providing a smooth transmission of power. A double mounting of antifriction bearings for the spindle, both front and rear, insures alignment. The spindle nose is the National Standard with the No. 50 series taper hole. Mounted upon a hinged plate, the driving motor is connected to the driving pulley by multiple-vee belts. Both the motor and drive unit are totally enclosed in the base of the headstock which carries the spindle carrier, readily accessible through the motor compartment door.

An automatic spindle stop, available on demand, actuated at the termination of the table feed by a dog and plunger, throws out the multiple-disk-friction driving clutch and applies the spindle brake while the table is reversing. The automatic spindle stop, an important safety feature for the operator while loading and unloading, prevents accidents or cutter marks on the work from the revolving cutter.

The standard series of table feeds, 1 to 40 in. per minute, are obtained by pick-off gears. Gears not in use are shelved, out of the way of the operator, in the door of the easily accessible feed-change gear compartment, located in the end of the bed.

Dog-controlled, automatic working cycles with intermittent feeds for the table, in either direc-

tion, permit accurately tripping the table at the point of reversal within .005 in. For a minimum of nonproductive time, a dog-controlled power rapid traverse of 250 in. per minute is standard equipment. Inasmuch as the rapid advance, rapid return, and feed movements of the table are dog controlled, the operator is released to load and unload additional machines. Hand operation is reduced to loading, starting and unloading.

A hydraulically operated backlash eliminator on the table leadscrew for climb milling can be provided. Backlash in both directions of table feed is eliminated by the automatic separation of two revolving nuts, the rotation of which drives the nonrotating hardened and ground feed screw. The backlash eliminator automatically releases during power rapid traverse and is applied only when the table is feeding.

Automatic lubrication to every essential bearing surface and moving part of the machine assures a minimum of maintenance. Pressure lubrication from a geared pump forces oil to the table ways, leadscrew and diving mechanism within the bed. The spindle carrier is supplied with oil from a

(Continued on page 81A)

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(Continued on page 73A)

plunger pump and a splash system lubricates the pulley bracket and reverse unit.

A one-piece arbor-support brace provides added rigidity for heavy cuts. Both the arbor supports and the cutter gangs can be removed without disturbing the brace itself. The Cincinnati rectangular overarm provides a rigid support to the cutter and positive alignment for the arbor. Large coolant splash guards, which are designed to trap sprayed and splashed coolant, permit the operator to work close to the machine. Coolant pump and piping are available as extras.

The machines weigh approximately 4,500 pounds net, each.

New Trade Catalogs

THE NEW BOOKLET "HACKSAW-OLOGY" is full of helpful hints on the care and use of hacksaw blades. The various types of blades are fully illustrated and described. Several pages are filled with suggestions for the proper operation of hacksaws for either hand or power-machine use. This 6 by 9-in. educational booklet is mailed free on request to the Simonds Saw and Steel Co., Fitchburg, Mass.

THE ATLAS PRESS COMPANY GENERAL CATALOG for 1939, released in January, presents the most complete information ever available on Atlas lathes, shapers, drill presses, arbor presses, and shop equipment. Twenty-four of its 72 pages are devoted to the new 10-in. Atlas lathes with power crossfeed. Copies are available from Atlas Press Co., Dept. 7, Kalamazoo, Mich. Ask for Catalog No. 39.

THE BOICE-CRANE COMPANY, woodworking machinery manufacturers of Toledo, Ohio, are announcing their 1939 catalog listing their complete line of 21 models in eleven types including circular saws, band saws, jig saws, shapers, grinder, sanders, jointers, drill presses, planers, tapping machines, and metal-spinning equipment.

Adding new models to their line for 1939 has required enlarging their catalog to 44 pages of interesting material for woodworkers, metalworking shops, industrial firms, and schools.

Trade News

RESEARCH WORK which goes on behind the scenes in the plant of a large manufacturer of valves, fittings, plumbing and heating equipment and pumps was revealed at an open house held by Crane Co., at its Chicago Works in the middle of November. The occasion was inspired by a notable expansion in the Crane research and engineering program.

Although research work has been a part of the Crane program for half a century it has been continually enlarged in recent years until today it occupies two 2-story buildings with a total floor space of 86,000 square feet and a personnel of 285. The staff ranges all the way from experts in metallurgy to specialists in the field of ceramics —a body of engineers spending their entire time in the work of controlling the quality of present products and looking ahead to their improvement.

On this occasion a book on the Crane Research Laboratories, describing its wide span of research activities in metallurgy, welding, radiography, industrial products, ceramics, sanitation, and hydraulics, heating, and air conditioning and the basic sciences, was distributed.

THE SOUTH BEND LATHE WORKS, South Bend, Ind., have just published a new 32-page catalog, No. 46–B, announcing a new 9-in. workshop precision lathe. The catalog is filled with more than 150 illustrations describing and showing the different types, important features, workmanship, and application of this back-geared, screw-cutting, metalworking lathe.

Eight different types of the 9-in. workshop lathe are shown, each available in 3-, 3½-, 4,- and 4½-ft. bed lengths. These different types are: Horizontal adjustable motor-driven bench lathe; 12-speed horizontal adjustable motor-driven bench lathe; V-belt horizontal adjustable motor-driven bench lathe; countershaft-driven bench lathe and floor leg lathe; pedestal adjustable motor-driven floor leg lathe; underneath-belt motor-driven bench lathe (not available in 4½-ft. bed); 9–11-in. workshop bench lathe with raising blocks, and the countershaft-driven floor leg oil-pan lathe.

Henry Ford extended a personal welcome to Ralph O. Lill recently when the 19-year-old Detroit boy became the 2500th student to enroll in the Ford Training School. Lill plans to learn tool and die making

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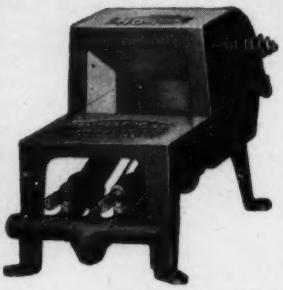

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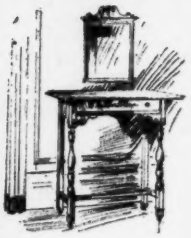

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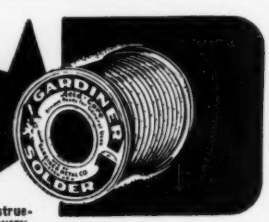

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